

4.10.2. Initiation

Any employee who detects the need for corrective action is responsible for and is authorized to initiate a corrective action. The initial source of corrective action can also be external to STL (i.e. corrective action because of client complaint, regulatory audit, or proficiency test). When a problem that requires corrective action is identified, the following items are identified by the initiator on the corrective action report; the nature of the problem, the name of the initiator and the date. If the problem affects a specific client project the name of the client and laboratory project number is recorded, and the PM is informed immediately.

4.10.3. Cause analysis

The corrective action process must be embarked upon as a joint, problem solving, constructive effort. Identification of systematic errors, or errors that are likely to occur repetitively due to a defect or weakness in a system, is particularly valuable in maintaining an environment of continuous improvement in laboratory operations.

When an NCM is initiated, the initiator works with the affected employee(s) and/or department(s) to identify the root cause of the problem. An essential part of the corrective action process is to identify whether the problem occurred due to a systematic or isolated error. If the initiator of the corrective action report is uncertain as to what would constitute appropriate corrective action or is unable to resolve the situation, the problem is brought to the Supervisor, Manager, Laboratory Director or the QA Manager who provides assistance in the corrective action process. The root cause of the problem and associated cause analysis is also documented in the electronic NCM.

4.10.4. Corrective Action

Once the root cause of a problem is identified, the initiator and affected employee(s) and/or department(s) examine potential actions that will rectify the present problem to the extent possible, and prevent recurrence of future, similar occurrences. An appropriate corrective action is then recommended. The corrective action must be appropriate for the size, and nature of the issue.

If the corrective action concerns a specific project-related issue the PM or Client Service 's Manager must approve the corrective action before it's implementation. Implementation of the corrective action and the date of implementation are documented in the electronic NCM. The NCM is routed automatically to the appropriate department management, PM, and QA Manager. This ensures the communication and awareness of the problem, the cause, and the action taken to prevent future occurrences and/or rectify the immediate problem.

4.10.5. Monitoring Corrective Action

All NCM's are automatically forwarded to the QA Department. The QA department reviews and electronically tracks all nonconformances and corrective actions. The QA department selects one or more of the more significant corrective actions for inclusion in the annual systems audit. The QA Department also may implement a special audit. The purpose of inclusion of the corrective action process in both routine and special audits is to monitor the implementation of the corrective action and to determine whether the action taken has been effective in overcoming the issue identified. A detailed description of this process is provided in the SOP, *"Nonconformance and Corrective Action System."*

4.11. Preventative Action

Preventative action is defined as noting and correcting a problem before it happens, because of a weakness in a system, method, or procedure. Preventative action includes analysis of the Quality System to detect, analyze, and eliminate potential causes of nonconformances. When potential problems are identified, preventative action is initiated to effectively address the problem to eliminate or reduce the risk identified. The preventative action process takes the same format as the corrective action process.

In order to prevent system down time, minimize corrective maintenance costs and ensure data validity, the laboratory employs a system of preventive maintenance. General preventive maintenance procedures, many of which are unique to particular instruments are outlined in each instruments' operation manual. All routine maintenance is performed as recommended by the manufacturer. The manuals also assist in the identification of commonly needed replacement parts, so that an inventory of these parts can be maintained at the laboratory.

It is the Section Supervisor's responsibility to make sure that the most current version of the operator manual is available in the laboratory. Routine maintenance is performed by the analyst while an external technician may be called in for major repairs. Certain instruments are on service contracts for major repairs. A bound maintenance log notebook is kept with each instrument to record all routine and non-routine maintenance. Notation of the data and maintenance activity is recorded every time service procedures are performed. This includes routine service checks by laboratory personnel as well as factory service calls. The return to analytical control following instrument repair is also noted in laboratory maintenance logbooks.

4.12. Records

4.12.1. Record Types are depicted in Table 6.

Table 6. STL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
Calibration	LQM	Audits/ Responses	COC / Documentation	Accounting
Computer Tapes/Disks/CD's/ DVD's	QMP	Certs/ permits	Contracts and Amendments	EH&S Manual, Permits, Disposal Records
QC Samples	SOP'/Work Instructions	NCM'	Correspondence	Employee Handbook
Sample data		Logbooks*	QAPP	OSHA 29 CFR Part 1910
Software (Version control)		Method & Software Validation/Verification	SAP	Personnel files, job descriptions, resumes, employee signatures & initials, training records
		MDL'/RL', QC Limits, Standards Certificates, Equip Monitoring Data	Logbooks QC Browser printouts	Technical and Administrative Policies

*Logbooks: Maintenance, Instrument Run/Analysis/Injection, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature.

4.12.2. Record Retention

Table 7 outlines STL's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is mailed to customers. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the document is formally retired. Records related to the programs listed in Table 8 have lengthier retention requirements and are not subject to STL's standard record retention policy.

Table 7. STL Record Retention Policy

Record Type	Archival Requirement
Raw Data	All* 5 Years from project completion
Controlled Documents	All* 5 Years from document retirement date
QC	All* 5 Years from archival
Project	All* 5 Years from project completion
Administrative	Personnel/Training 7 years
Accounting	All* See Accounting and Control Procedures Manual

- Exceptions listed in Table 8.

4.12.3. Programs with Longer Retention Requirements

Specific client projects and regulatory programs have longer record retention requirements than the STL standard record retention time. In these cases, the longer retention requirement is noted in the general comments section of the quote in LIMS. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data are marked as to who to contact for authorization prior to destroying the data.

Programs with record retention requirements greater than five years are detailed in Table 8.

Table 8. Special Record Retention Requirements

Program	Retention Requirement
Colorado – Drinking Water	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
OSHA - 40 CFR Part 1910	30 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

4.12.4. Record Transfer Upon Ownership Changes

STL ensures that all records are maintained as required by the regulatory guidelines and per the QMP upon facility location change or ownership transfer. Upon STL facility location change, all archives are retained by STL in accordance with the QMP.

Upon ownership transfer, vital records will be transferred to the new owner. If the laboratory goes out of business, vital records will be transferred to another operating STL laboratory or to our clients.

4.12.5. Records Archival

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented. Off-site facilities that STL uses for long-term storage meet the requirements as defined by the QMP.

4.13. Internal Audits

4.13.1. Audit Types and Frequency

There are several different types of internal audits performed at STL. Audit type and frequency are categorized in Table 9.

Table 9. Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual
Analytical Reports	QA Department	As necessary to ensure an effective secondary review process
Data Authenticity	QA Department or Designee	100% of all analysts annually
Electronic Data Audits	QA Department or Designee	100% of all organic instruments
Special	QA Department or Designee	As Needed

4.13.2. Systems Audits

Facility systems audits are technical in nature and are conducted on an ongoing basis by the QA Manager or his/her designee. Systems audits cover all departments of the laboratory, both operational and support. Systems reviews can be in the form of SOP compliance audits or general audits of functional areas.

The audit report is issued by the QA Manager within 30 calendar days of the audit. The audit report includes the following elements: Introduction, Scope of Audit, Type of Audit, Notable Practices, Deficiencies, and a timeframe within which the audit findings must be addressed. The audit report is addressed to the Department Manager, and copied to the Laboratory Director.

Written audit responses are required within 30 calendar days of audit report issue. The audit response follows the format of the audit report, and corrective actions and time frames for their implementation are included for each deficiency. The audit response is directed to all individuals copied on the audit report. Where a corrective action requires longer than 30 days to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the QA Department in the agreed upon time frame. The audit findings are entered and tracked using a database by the QA personnel.

STL Los Angeles LQM

4.13.3. Data Audits

Data audits are focussed to assess the level of method compliance, SOP compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOP's, technical policies, and project-specific QC criteria.

A data auditing frequency target of 5% has been established. The QA Department provides feedback and/or corrections and revisions to project reports where necessary. The frequency of auditing final reports depends on the effectiveness of the laboratory's secondary review process. If the laboratory infrequently finds report errors or there is a low percentage of revised reports, audits may be less frequent. Data audits must include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to the STL Corporate Manual Integration Policy.

Records of the data audits are kept, and the frequency of data audits is included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised following the procedure outlined in the STL Policy, SANA-QA-0011, *Report Revision*, and the revision sent to the client by the responsible PM. The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for process evaluation and change.

Where specific clients and regulatory programs require more frequent data auditing, the individual facility meets the data auditing frequency for that program. The audit findings are entered and tracked using a database by QA personnel.

4.13.4. Data Authenticity Audits

Data authenticity audits shall be performed on 100% of all analysts by the QA department or a designate independent from the operations. Performing data authenticity checks will typically include verifying raw data, evaluating calculation tools and independently reproducing the final results and comparing it to the Hard copy on randomly selected batches of data. The laboratory will report the percentage of analysts reviewed (for the year) in their monthly QA report.

4.13.5. Electronic Data Audits

Electronic data audits shall be performed on 100% of all organic instruments by the QA department or a designate independent from the operations. Typically this will include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review. The laboratory will report the percentage of instruments reviewed (for the year) in their monthly QA report.

4.13.6. Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focussed on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

4.14. External Audits

STL facilities are routinely audited by clients and external regulatory authorities. STL is available for these audits and makes every effort to provide the auditors with the personnel, documentation, and assistance required by the auditors. STL recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit. Findings from external audits are addressed in writing within the time frame specified by the auditing authority.

4.15. Management Reviews

4.15.1 QA Reports to Management

A monthly QA report is prepared by the QA Manager and forwarded to the Laboratory Director and the Corporate QA Manager. The reports include statistical results that are used to assess the effectiveness of the Quality System. The basic format of the monthly report is shown in Figure 3.

A Corporate QA Report containing a compilation of the Facility QA reports statistics, information on progress of the Corporate QA program, and a narrative outlining significant occurrences and/or concerns is prepared by the Corporate QA Manager and forwarded to the COO.

4.15.2 Management Systems Review

A management systems review is performed on an annual basis. It is scheduled in February and must occur by March 31. It is a meeting between the Lab Director and the QA Manager or QA Staff. The management systems review ensures that the laboratory's quality system is adequate to satisfy the laboratory's policies and practices, government requirements, accreditations, inter-laboratory proficiency tests, approval requirements, and client expectations. Management systems reviews are documented using a checklist covering all the elements described in the LQM and a report providing the findings and actions:

- Suitability of policies and procedures
- Internal Audit reports
- External Audit Reports
- Corrective and preventative actions
- Status of QA documents
- PT Study status
- Client feedback and complaints
- Work load volume affecting resources available and needed

Figure 3. Monthly QA Report Format

Metrics spreadsheet format	Audits
	Internal System Audits External System Audits
	Revised reports/Client Feedback
	Revised Reports Client Complaints Client Compliments
	Certification Changes
	Changes - Losses/revocations
	Proficiency Testing
	Study participation and scores – total participated in / total acceptable as a % Repeat failures – 2 out of last 4 must be noted
	SOP Status
	The percentage of SOP's that have been revised or reviewed within the last 24 months
	Miscellaneous QA and Operational Issues
	Narrative outlining improvements, regulatory compliance issues and general concerns
	Metrics Spreadsheet
	Summarize metrics in the template provided by the Corporate Quality Director

5 Technical Requirements

5.1 Personnel

5.1.1 General

STL management believes that its highly qualified and professional staff is the single most important aspect in assuring the highest level of data quality service in the industry. STL's staff consists of 46 professionals and support personnel that include the following positions:

- Regional General Manager
- Laboratory Director / Technical Director
- Quality Assurance Manager / EH&S Coordinator
- Client Services Manager
- Deputy Technical Director
- Department Manager
- Business Development Manager
- LIMS Administrator
- Project Manager
- Analyst/Chemist/Technician
- Sample Receiving

In order to ensure that employees have sufficient education and experience to perform a particular task, job descriptions are developed and maintained for all personnel.

5.1.2 Training

STL is committed to furthering the professional and technical development of employees at all levels. Personnel training procedures begin with an established orientation program designed to familiarize the new associate with safety and chemical hygiene issues, the importance of quality assurance/quality control in the analytical laboratory, and company policies and benefits. The basic elements of the orientation and training program are outlined in the *SOP, SANA-QA-0016, Employee Orientation Program*.

The level of training necessary to perform analytical tasks is determined from employees academic background and past experience, technical courses, and on the job training with specific methods or instrumentation. The responsibility for formal academic lies foremost with the individual. The responsibility for the additional specialized skills obtained through in-house training or external workshops is a shared obligation of the individual, their supervisor, and the laboratory. An individual's academic and professional experience is kept on file including an initial statement of qualifications or resume and any additional documentation concerning subsequent training. Copies of certificates of completion, transcripts, diplomas, or other documentation are included in the training files as appropriate.

New associates for all departments undergo the same orientation procedure. In addition, if needed, personnel are trained in basic laboratory functions by the Department Managers or designee within their first 30 days of employment. The basic training functions covered include:

- | | | |
|------------------------|----------------------|------------------------------|
| * Weighing | * Titration | * Use of Syringes |
| * Pipetting | * Understanding Data | * Glassware Use/Practices |
| * Safety Practices | * Filtration | * Math and the Metric System |
| * pH Measurement | * How to read MSDS's | * Use of General Lab Equip. |
| * Hazard Communication | | * Mixing & Sampling |

In order to ensure that the policies and objectives of this LQM are communicated to all new personnel, all associates are required to read this LQM during the training process. This training is documented and included in the training files of each associate. Trainees are under the supervision of experienced analysts who are responsible for showing them the analytical procedures including applicable QA/QC measures. A new analyst is not permitted to perform an analysis until their supervisor is confident that the analytical and QA/QC procedures can be carried out correctly and demonstration of capability (DOC) is documented.

STL has a fundamental responsibility to provide facilities, equipment, maintenance, and an organized program to make necessary improvements to ensure a safe working environment. Unless associates fulfill their responsibilities for laboratory safety, the safety-related features of the facility and established safety programs will be ineffective.

The laboratory Safety and Health Management Program provides a complete discussion of the safety policies enforced by the laboratory. A copy of the manual is distributed to each laboratory area. New employees undergo required environmental health and safety orientation within 30 days of hire date. Minimum training requirements for STL employees are outlined in Table 9.

Table 9. STL Employee Minimum Training Requirements

Required Training	Time Frame*	Employee Type
Environmental Health & Safety	1 month	All
Ethics Data Integrity	1 month	All Technical and PMs
Ethics Refresher	Annually	All
Quality Assurance	90 days	All
Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical
Manual Integration Training	Prior to generating, reporting or reviewing data	Technical and PM's

*From date of initial employment unless otherwise indicated.

Technical training is accomplished within each laboratory by management to ensure method comprehension. All new personnel are required to demonstrate competency in performing a particular method by successfully completing an Initial Demonstration of Capability (IDOC) study before conducting analysis independently on client samples. On-going proficiency must be demonstrated annually.

IDOC's are most commonly performed by analysis of four replicate QC check samples or four Laboratory Control Samples (LCS). As required by the method reference, the accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the four replicate results are calculated and compared to the method limits or against current laboratory limits. (If the test method does not include accuracy and precision requirements, the results are compared to in-house criteria set by the laboratory.)

The laboratory sets the target criteria such that they reflect the data quality objectives of the specific test method. A DOC Certification Statement is created and maintained in the employee's training file. This document must be signed by the Analyst, Lab/Technical Director and the QA Manager. The DOC certification must include a statement that the individual has read, understood and agreed to perform the most recent version of the test procedure. (Figure 4 shows an example of a DOC Certification.) In procedures such as %solids, Color, Dissolved Oxygen, Ignitability, etc., where spiking is not an option and for which QC samples are not readily available, the proficiency can be demonstrated by analyzing duplicates samples with a QC acceptance criteria of RPD <10%.

5.1.3. On-Going Training

STL has a commitment to make sure that all analysts remain proficient in the tests that they perform. Documentation of continued proficiency is recorded in each analyst's training file for each method they perform. Annual Proficiency is documented by one of the following:

- The acceptable performance of a double blind PT sample;
- Successful analysis of a blind performance sample on a similar test method using the same technology requiring documentation for only one of the test methods; and
- At least four consecutive LCS's with acceptable levels of precision and accuracy.

Additionally, SOP's are reviewed annually and analysts are required to read the latest version of the SOP. This training is documented in the training files. Performance evaluations are routinely analyzed by the laboratory and performance is tracked and recorded in analyst's training files.

Figure 4. Example Demonstration of Capability Certification

Demonstration of Capability Certification Statement		
Date: Laboratory Name: Laboratory Address: Analyst Name:	Matrix: Method:	
<p>We the undersigned certify that:</p> <ol style="list-style-type: none"> 1. The analyst identified above, using the cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, has met the Demonstration of Capability. 2. The test method was performed by the analyst identified on this certification. 3. Copies of the test method and SOP are available for all personnel on site. 4. The data associated with the DOC are true, complete and representative. 5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is available for review by authorized inspectors. 		
_____ Laboratory Manager	_____ Supervisor	_____ Date

5.1.4. STL Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times; STL has established an Ethics Policy, P-L-006 and an Ethics Agreement (Figure 5). Each employee shall sign the Ethics Agreement, signifying agreed compliance with its stated purpose. The Ethics policy is initially presented to all new hire employees and all employees undergo annual refresher training. After the annual training is completed, all employees sign a new Ethics agreement thus reconfirming their continued commitment to the Ethics policy.

Ethics is a major component of STL's quality and data integrity systems. Each employee is trained in ethics upon hire and within 30 days of hire they undergo a comprehensive Ethics training program. This program includes an in-depth look at Ethics issues, a review of the ethics statement, and group discussions about data integrity and data misrepresentation. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. A 24 hour data integrity hotline is maintained by the STL Corporate QA Manager.

Violations of the Ethics policy will not be tolerated. Employees who violate the policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize the ability of STL to work on Government contracts. For that reason, the Company has a zero tolerance approach to such violations.

Figure 5. Ethics Agreement

I understand that STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- I will not intentionally report data values that are not the actual values obtained;
- I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;
- I will not intentionally misrepresent another individual's work;
- I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operating Procedures, or as defined by Company Policy;
- I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner; and I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees; and
- If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of senior management, up to and including the President of STL.

As a STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner. I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees. I have read this Ethics Agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination from the Company.

Compliance with this policy of business ethics and conduct is the responsibility of every STL employee. Disregard or failing to comply with this standard of business ethics and conduct could lead to disciplinary action, up to and including possible termination of employment. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the

5.2 Description of Facilities

5.2.1 General

The 27,000-square-foot facility is designed to provide inorganic and organic analyses of multi-media environmental samples that include air, wastewater, soil, sediment, sludge, biological tissue, oil and hazardous waste samples. The design of the laboratory ensures data quality, safety, efficiency, automation, and security. Instrument laboratories are separate from the sample preparation laboratories to eliminate potential for cross sample contamination. Ventilation of the instrument laboratory for volatile organic constituent (VOC) analyses is set up to prevent solvent contamination. The reagent water system provides water of the required quality for standard and QC sample preparations and laboratory operations. 528-linear feet bench top provides more than adequate space for processing and analytical operations.

Organic instrumental analyses are performed in two separate analytical laboratories. The laboratory designated for VOC analyses is equipped with positive pressure ventilation to prevent organic vapors from entering the laboratory. A separate laboratory is designated as the Semivolatile Organics and Metals laboratory. It is equipped with GC/MS's or GC's for analyses of Semivolatile compounds and PCBs and ICPAES and Mercury analyzers for metals analysis. The laboratory floor plan is depicted in Figure 6.

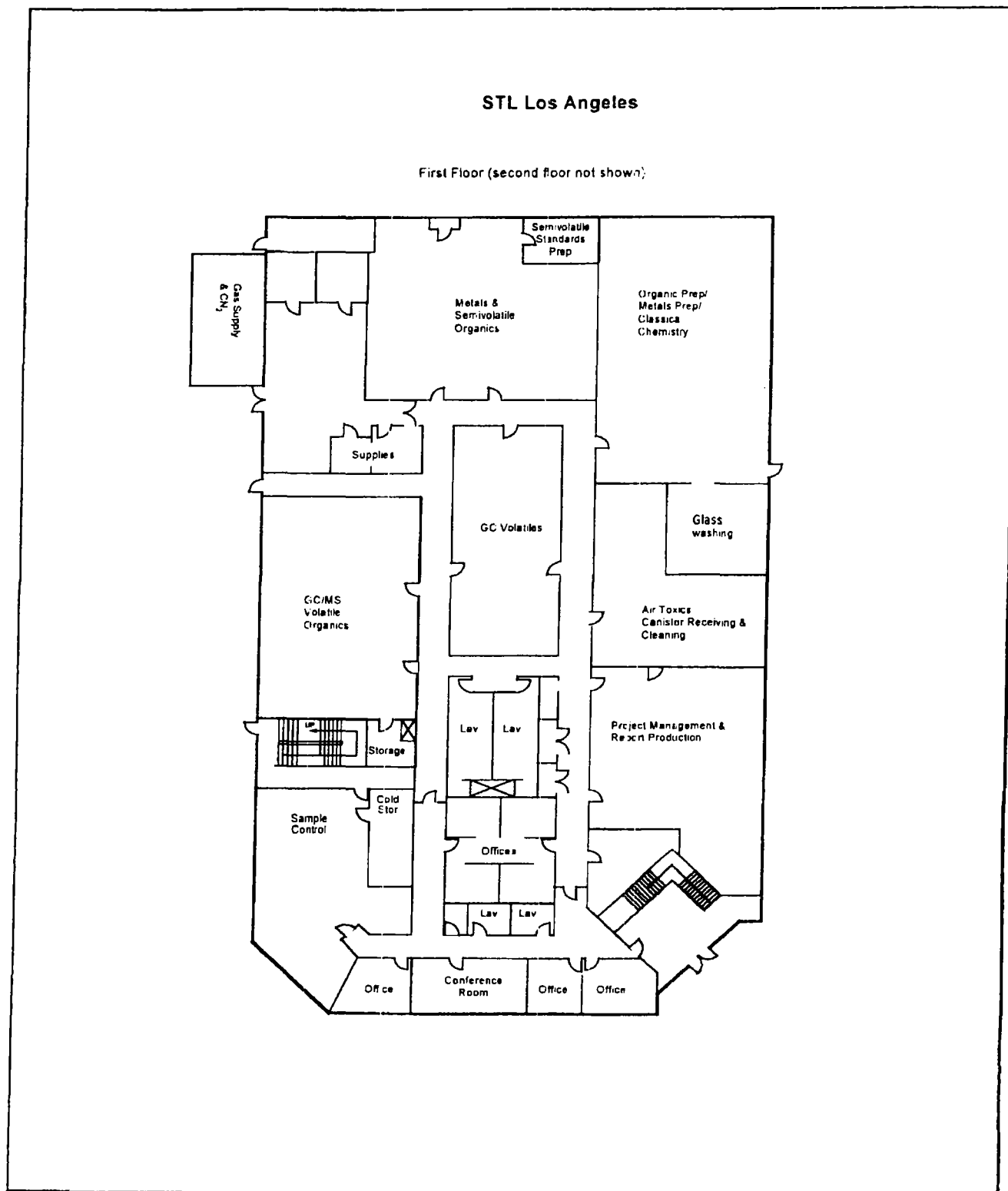
Extractions of organic samples are performed in the preparation laboratory. This laboratory is equipped with negative pressure ventilation to prevent solvents from entering instrument laboratories and the hallways. These areas are designed to ensure safe and efficient handling of samples and extracts. This preparation laboratory allows the laboratory personnel to perform acid digestion, TCLP extractions, distillations, filtration, and simple physical characteristic (pH and percent moisture) determinations following applicable methods. The nonmetal analyses section of the preparation lab is equipped with ion chromatographs (IC), carbon analyzer, spectrophotometer, ion selective electrodes (ISE), total organic halide (TOX) analyzer, and titration systems. A list of instrumentation and supporting equipment can be found in Table 10.

The laboratory facility has a reverse osmosis systems for centralized high purity water system, a computer network, and centralized gas distribution to support its' analytical services.

The laboratory area is considered a secured area and is restricted to authorized personnel only. Because of the nature of STL's work, adequate security of the facilities, equipment, and project files is necessary. Access to the facility is controlled through a system of electronic access cards. All visitors sign in, and are escorted by STL personnel while at an STL facility. Laboratory Department Managers ensure that their personnel are familiar with STL's security policies.

STL Los Angeles is designed for efficient, automated high-quality operations. STL's laboratory is equipped with Heating, Ventilation, and Air Conditioning (HVAC) systems appropriate to the needs of environmental testing laboratories and to meet the needs of the Methylene Chloride Emissions Standard. Environmental conditions in the facilities, such as hood flow, are routinely monitored and documented.

Figure 6. Laboratory Floor Plan



5.2.2 Contingency Planning

An effective QA Program must emphasize contingency planning, actions to prevent problems from reoccurring, and to ensure timely and effective completion of a measurement effort. The following are considered relative to contingency planning:

- Staffing - A primary objective is to ensure that qualified staff are always available to perform the necessary analytical work, regardless of employee turnover, vacation (personal time off), illness, or other absence. Sources of qualified staffing may include temporary agencies specializing in providing technically trained personnel and other STL facilities. Employee qualification requirements are described in Section 5.1.
- Redundant Instrumentation or Equivalent Methods - In certain areas of the laboratory, redundant instrumentation is available to ensure uninterrupted workflow. The laboratory may also choose to lease equipment when there is a sufficient time window prior to arrival of samples. However, in circumstances where a catastrophic instrument failure occurs, alternative but equivalent methods may be recommended to the client for approval and implementation.
- Preventive Maintenance - Preventive maintenance program is designed to minimize analytical instrument malfunctions, permit simple adjustments, and to ensure fewer and shorter breakdowns of critical analytical equipment. (See Section 5.4, "Equipment Maintenance".)
- Network Laboratories & Subcontractor Laboratories - To support the laboratory during peak periods or in the event of a critical instrument malfunction, STL has the capability to arrange the use of other network laboratories or qualified analytical laboratories as subcontractors for short-term backup analytical support. Any use of a subcontractor laboratory is approved by the client prior to award of a contract or sample shipment for existing contracts.
- Uninterruptable Power Supply - An Uninterruptable Power Supply (UPS) system which provides line conditioning and backup power to the LIMS computer system/server. This contingency plan allows sufficient time for the main computer system to be shut down and for data archival. All electronic data that are stored on the main computer system and on the individual personal computer (PC) hard drives are backed up at regular intervals.

5.3 Test Methods

5.3.1 Method Selection

Most of the test methods performed at STL originate from test methods published by a regulatory agency such as the USEPA and other state and federal regulatory agencies. These include, but are not limited to, the following published compendiums of test methods. Appendix A lists the analytical methods performed at STL

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, USEPA, January 1996.

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water.

Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991.

Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992.

NIOSH Manual of Analytical Methods, 4th ed., August, 1994.

Statement of Work for Inorganics Analysis, ILM04.0, USEPA Contract Laboratory Program Multi-media, Multi-concentration.

Statement of Work for Organics Analysis, OLM03.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.

Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, OLMO4.1, USEPA Contract Laboratory Program, September 1998.

Standard Methods for the Examination of Water and Wastewater, 18th/19th/20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.

Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.

National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.

5.3.2 SOP's

STL maintains an SOP Index for all standard and laboratory developed methods. Method SOP's are maintained to describe a specific test method. Procedural SOP's are maintained to describe function and administrative procedures not related to a specific test method. Appendix C provides a list of current, active SOP's in use. Appendix D is list of essential QA SOP's and policies that are referenced in this manual.

Method SOP's contain the following information:

Title Page with Document Name, Document #, Revision #, Effective Date, Page #'s and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 7).

1. Scope and Application, including test analytes, identification of test method, applicable matrix, and method reporting limits
2. Summary of the Test Method
3. Responsibilities
4. Definitions
5. Interferences
6. Safety
7. Equipment and Supplies
8. Reagents and Standards
9. Sample Collection, Preservation and Storage
10. Quality Control, including Data Assessment and Acceptance Criteria for Quality Control Measures, Corrective Actions for Out-of-control Data, and Contingencies for Handling Out-of-Control Data.
11. Calibration and Standardization
12. Procedure
13. Calculations
14. Method Performance
15. Pollution Prevention
16. Waste Management
17. References
18. Tables, Diagrams, Flowcharts, Attachments and Validation Data

Procedural SOP's contain the following information:

Title Page with Document Name, Document #, Revision #, Effective Date, Page #'s and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 7).

1. Scope
2. Summary
3. Definitions
4. Responsibilities
5. Safety
6. Procedure
7. References
8. Tables, Diagrams, Flowcharts

The QA Department is responsible for maintenance of SOP's, archival of SOP historical revisions, and maintenance of a current SOP index. SOP's, at a minimum, undergo annual review. Where an SOP is based on a published method, the laboratory maintains a copy of the reference method.

Figure 7. SOP Proprietary Information Statement

This documentation has been prepared by Severn Trent Laboratories (STL) solely for STL's own use and the use of STL's customers in evaluating its qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to STL upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use it for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

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Deviations from the Method

In some cases, a standard laboratory procedure is modified slightly to accommodate analytical instrument conditions or to minimize waste. In these cases, a subsection in the References is included which indicates the modifications to the SOP which are specific to that project.

SOP's are written procedures for standardized methods (i.e. SW-846, EPA-200, 500, and 600 series methods) to document specific laboratory procedures which satisfy the general requirements specified in the individual methods and to explain any differences between the application of the established method and the published procedure. If any difference exists between STL's SOP and a standard method's specific procedures, method validation studies are performed to document the fact that the change does not adversely affect the applicability of the method. In general, every effort is made to adhere to the protocols of the standard method.

5.3.3 Method Validation

Laboratory developed methods are validated and documented according to the procedure described in Section 5.3.5.

5.3.4 Method Verification

Method verification is required when a validated standard test method or a method modification is implemented. The level of activity required for method verification is dependent on the type of method being implemented, or on the level of method modification and its affect on the method. Method modification often takes advantage of the ability to make minor changes in a method without affecting the method's outcome. Method verification commonly will minimally require Determination of Method Sensitivity and Determination of Accuracy and Precision as described in Section 5.3.5. When implementing new, but previously validated methodologies, method verification may require additional activities such as Determination of Range.

5.3.5 Method Validation and Verification Activities

Before analyzing samples by a particular method, method validation and/or method verification must occur. A complete validation of the method is required for laboratory developed methods. While method validation can take various courses, the following activities are generally required as part of method validation. Method validation records are designated QC records and are archived accordingly.

Determination of Method Selectivity - Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity - Method sensitivity is determined using detection limit studies. Method detection limit (MDL) studies are performed using the criteria in 40 CFR Part 136 App. B and are described in the Corporate SOP, *Method Detection Limit Studies*. Instrument detection limits are performed where required by specific data quality objectives or regulation.

Determination of Interferences - A determination that the method is free from interferences in a blank matrix is performed.

Determination of Range - Where appropriate, a determination of the applicable range of the method is performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

Demonstration of Capability - DOC's are performed prior to initial method performance or following trouble shooting of analytical methods. Analysts and Technicians must complete a valid DOC study on an annual basis.

Determination of Accuracy and Precision - Accuracy and precision studies may be required as a separate determination from the DOC. Accuracy and precision studies are generally performed using four replicate LCS analyses, with a resulting % recovery and measure of reproducibility (SD, RSD) calculated and measured against a set of target criteria.

Documentation of Method - The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Appendix or a SOP sub section describing the specific differences in the new method is acceptable in place of a separate SOP.

Continued Demonstration of Method Performance - Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch-specific QC samples such as LCS's and Method Blanks.

Determination of Reporting Limits - The MDL is the approximate limit at which an analyte can be qualitatively detected using a specific method at a 99% confidence interval. The MDL is a statistically calculated value and measures the sensitivity of an entire method and is independent of device. The Reporting Limit (RL) or Limit of Quantitation is the limit at which a compound can be qualitatively detected and quantified at a 99% confidence interval. The RL's are also set based on specific knowledge about the analyte, project specific requirements and/or regulatory requirements. The RL is always greater than the MDL and is typically set based on 2-10 times the MDL.

STL reports results to the sample-specific RL's. The low calibration standard is set at or below the laboratory RL to monitor method sensitivity per instrument per calibration. Sample specific RL's are derived by taking into account various sample specific data, which can include the amount of the sample subject to testing, percent moisture, dilution factors, interferences and the base RL's for the analysis.

In some cases, it is appropriate to report values between the MDL and the RL. In this region, an analyte can be qualitatively detected, but not accurately quantified. Any data reported in this region is flagged with a "J" for organics and a "B" for inorganics to note that it's an estimated value.

5.3.6 Data review

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. All levels of the review are documented. The SOP, SANA-QA-0010, *Technical and Compliance Assessment of Analytical Data* describe details of this process.

Primary Technical Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (prepares and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project-specific requirements have been understood and followed. If directions to the analyst are not clear, the analyst must go to the Supervisor, Manager, or PM, who must clarify the instructions.

Once an analysis is complete, the primary reviewer ensures that:

- Sample preparation information is complete, accurate, and documented.
- Initial and/or continuing calibrations are valid.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate and the reason for the MI is documented.
- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and signature or initials of primary analyst
- Client specific requirements have been followed.

- Method and process SOP's have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- NCM's and/or anomalous data have been properly documented and communicated.
- COC procedures have been followed.
- *Primary review is documented by date and initials of primary analyst on preprinted checklists*

Any anomalous results and/or nonconformances noted during the Primary Review are communicated to the Supervisor and the PM for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification. Nonconformances are documented using the NCM system per Section 4.9.

Revisions are never erased, deleted or written over. They are corrected by drawing a single line through the error, documenting the correction, then the initials and date are recorded by the person who edited the data.

Secondary Technical Review

The secondary review is a complete technical review of a data set. The secondary review is documented and the secondary reviewer is identified. The following items are reviewed:

- Qualitative Identification
- Quantitative Accuracy
- Calibration
- QC Samples
- Method QC Criteria
- Adherence to method and process SOPs
- Manual Integrations – as verified by date and initials of first and secondary data reviewer.
- Special Requirements/Instructions

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or reintegration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures.

Completeness/Project Management Review

The completeness review includes the generation of a project narrative and/or cover letter which outlines anomalous data and noncompliances using project narrative notes and non-compliance reports generated during the primary and secondary review. The completeness review focuses on the accuracy of final client reporting forms and addresses the following items:

- Is the project report complete?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?
- Are QC failures approved and appropriately explained in the narrative notes?

Logbook Reviews

All logbooks and records of routine monitoring (whether bound or on loose sheets) are reviewed monthly to ensure accuracy and compliance with its SOP and this policy. This review is performed by a Supervisor or a designee. Review is documented by writing the date and signature or initials of the reviewer. The signature may be on every page or the reviewer can sign a single page and document the specific pages reviewed. Run logs are reviewed as part of the primary and secondary technical data reviews.

5.3.7 Data Integrity and Security (Software Validation)

This section details those procedures that are relevant to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data.

Security and Traceability

Access to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data is both controlled and recorded. There are various systems at STL to which this applies, which include the Laboratory Information Management System (LIMS), as well as specific systems such as a chromatography data system. The hardware and software security for the LIMS system is maintained by the Corporate IT Department.

Control of the system is accomplished through limitation of access to the system by users with the education, training and experience to perform the task knowledgeably and accurately. System users are granted privileges that are commensurate with their experience and responsibilities. The SOP, *Instrument Transfer and Backup*, further defines the roles and responsibilities of those dealing with electronic data files.

Computer access is tracked by using unique login names and passwords for all employees that have access to the computer system. "General" or "multi-user" account access to computer systems that collect, analyze and process raw instrumental data, and those that manage and report data is not allowed. Entries and changes are documented with the identity of the individual making the entry, and the time and date.

Where a computer system is processing raw instrumental data, the instrument identification number as described in Section 5.4.1 is recorded. Many of these systems, such as the Target Data System, have the capability of maintaining audit trails to track entries and changes to the data. This function is activated on any computer system that has that capability. The QA Department routinely conducts electronic data audits of all organic instruments. This will include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review.

Verification

All commercially obtained software is verified by an independent person prior to use and after version upgrade and approved for use by the QA staff. Verification involves assessing whether the computer system accurately performs its intended function. Verification generally is accomplished by comparing the output of the program with the output of the raw data manually processed, or processed by the software being replaced.

The records of the verification are required to contain the following information: software vendor, name of product, version, comparison of program output and manual output, raw data used to verify the program, date, and name of the individual performing the verification. Records of verification are retained as QC records.

Validation

Software validation involves documentation of specifications and coding as well as verification of results. Software validation is performed on all in-house programs. Records of verification include original specifications, identity of code, printout of code, software name, software version, name of individual writing the code, comparison of program output with specifications, and verification records as specified above. Records of validation are retained as QC records.

Version Control

The laboratory maintains copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of five years from its retirement date.

5.4 Equipment

5.4.1 Equipment Operation

STL is committed to routinely updating and automating instrumentation. STL facilities maintain state of the art instrumentation to perform the analyses within the QC specifications of the test methods. Each STL facility maintains an equipment list that includes the following information:

- Identity
- Date Installed
- Manufacturer's Name, Model Number, Serial Number
- Current Location
- Preventative Maintenance Schedule

All equipment is subject to rigorous checks upon its receipt, upgrade, or modification to establish that the equipment meets with the selectivity, accuracy, and precision required by the test method for which it is to be used. All manufacturer's operations and maintenance manuals are kept up to date and accessible for the use of the equipment operator. Documentation of equipment usage is maintained using analytical run and maintenance logbooks.

A comprehensive list of major instrumentation available, along with supporting equipment can be found in Table 11.

Table 11. Active Analytical Instrumentation and Supporting Equipment

Manufacturer	Model	Serial No.	Dates Received & Placed in Service	Instrument ID
Air Toxics Laboratory – GC/MS				
Hewlett-Packard	5890/5970 – GC/MS	2845A11456	1988	MSA
Hewlett-Packard	5890/5970 – GC/MS	3004A12498	1989	MSB
Hewlett-Packard	5890/5972 – GC/MS	US1034066	2004	MSC
HP-Agilent	6890/5973 – GC/MS	US63810199	1997	MSD
HP-Agilent	6890/5973 – GC/MS	US10244159	2003	MSE
Air Toxics Laboratory GC				
Varian	3400 GC - FID/TCD	4081	1988	GC1
Varian	3600 GC – PID/FID/ELCD	0349	1988	GC2
Varian	CP-3800 GC - FID/FID/TCD	05262	2001	GC3
Varian	3400 GC - FPD	4155	1990	GC4
Varian	3400 GC - FID/PID	4154	1991	GC5
Varian	3400 GC - FID/PID	4468	1991	GC6
Varian	CP-3800 GC – PFPD/PID/FID	10418	2003	GC7
Soil & Water Laboratory GC/MS				
Hewlett Packard	5970 GC/MS semi	3034A12959	1988	MSE
HP - Agilent	5973 GC/MS semi	US21863660	2002	MSI
HP - Agilent	5973 GC/MS	US93122851	2000	MSJ
HP - Agilent	5973 GC/MS	US93122873	2000	MSK
HP - Agilent	5973 GC/MS	US309659018	2003	MSN

Manufacturer	Model	Serial No.	Dates Received & Placed in Service	Instrument ID
HP - Agilent	5973 GC/MS	US33220083	2003	MSO
HP - Agilent	5973 GC/MS	US33220240	2004	MSP
HP - Agilent	5973 GC/MS	US33220184	2003	MSQ
HP - Agilent	5973 GC/MS	US35120285	2004	MSR
HP - Agilent	5973 GC/MS semi	US41720775	2004	MSS
Soil & Water Laboratory GC				
Hewlett Packard	5890 GC - FID	2843A21016	1989	G01
Hewlett Packard	5890 GC - FID/FID	2643A11589	1987	G02
Hewlett Packard	5890 GC - FID	2643A11588	1987	G03
Hewlett Packard	5890 GC - Screening	2843A19511	1998	G04
Hewlett Packard	5890II GC - dual ECD	2950A27176	2000	G05
Hewlett Packard	5890 GC - dual ECD	2750A19102	1988	G06
Hewlett Packard	5890 GC - dual ECD	2623A08412	1986	G07
Hewlett Packard	5890II GC - dual ECD	3108A33873	1991	G08
Hewlett Packard	5890II GC - ECD	2950A27848	1991	G09
Hewlett Packard	6890N GC - Dual mini ECD	U510322076	2003	G10
Hewlett Packard	5890II GC - FID/PID/PID	3029A29982	1990	G13
Hewlett Packard	5890 GC - FID/PID	2843A19495	1993	G15
Hewlett Packard	5890 GC - FID/PID/PID	2541A06784	1986	G16
Hewlett Packard	1100 HPLC - PDA/FLD	DE14916533	2002	G20

Manufacturer	Model	Serial No.	Dates Received & Placed in Service	Instrument ID
Soil & Water Laboratory - Metals				
Thermo Jarrel Ash	ICP-AES -61E - Trace	276490	1990	M01
Leeman	AAS -PS200II	HG-8005	1999	M04
Thermo Jarrel Ash	ICP-AES -61	44982	2000	M06
Thermo Electron	ICPMS - X Series	X0376	2004	M09
Soil & Water Laboratory - General Chemistry				
Dionex	Ion Chromatograph - DX-500	94040149	1993	W01
Man-Tech	Auto-titrator - PC-1104-00	MS-9L8-373	1999	W04
Accument	PH Meter - Model 15	C0024955	--	W07
Rosemont Dohrmann	TOC - DC-190	96208007	2000	W08
Precision Scientific	Flashpoint	10BA-6	2000	W10
VWR Scientific	Turbidity Meter - 34100-787	TUR 800 1101	2000	W12
Orion	MV Meter - EA940	PS93A	1985	W13
Orion	MV Meter - 920A	001030	2000	W14
American Scientific Products	Balance - ER-180A	2904054	--	W15
American Scientific Products	Balance - SP180	2903779	--	W16
Hach	Spectrophotometer Prep lab	HACH	2000	W17
Dionex	Ion Chromatograph - DX-600	01070608	2001	W18
Dionex	Ion Chromatograph - DX-600	03080261	2003	W19
Dionex	Ion Chromatograph - DX-600	0406060595	2004	W20

Information Systems

- All terminals, PCs and printers are connected on an integrated MS Windows NT® Local Area Network (LAN) via network switches, routers and wide area links.
- Extensive variety of software to aid in data analysis and presentation: AS/400 database system, Microsoft Office 97 Products (Access, Excel, Word, etc), and Visual Basic programming environment.
- The GC division utilizes TurboChrom data systems. The Target System is used by the GC/MS labs. All our other systems have been custom designed internally. The data are autoloading to a central LIMS where it undergoes a rigorous QC review.
- Management personnel have access to the Internet for additional resources.

5.4.2 Equipment Maintenance

STL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. All routine maintenance is performed as recommended by the manufacturer and may be performed by an analyst, instrument specialist or outside technician. Refer to Table 12 for a list of preventative maintenance schedules for major lab equipment.

Maintenance logbooks are kept on all major pieces of equipment in which both routine and non-routine maintenance is recorded. Notation of the date and maintenance activity is recorded each time service procedures are performed. The return to analytical control following instrument repair is documented in the maintenance logbook. Maintenance logbooks are retained as QC records. Maintenance contracts are held on specific pieces of equipment where outside service is efficient, cost-effective, and necessary for effective operation of the laboratory.

Table 12. Equipment and Instrument Maintenance Schedules

Instrument Maintenance Schedule	
Ion Chromatograph	
Frequency	Maintenance Items
As Needed	Check fuses when power problems occur Change column when peak shape and resolution deteriorate or when retention time shortening indicates that exchange sites have become deactivated. Prime pump head when flow is erratic.
Daily	Check plumbing/leaks. Check gases. Check pump pressure. Check conductivity meter. Check pump heads for leaks.
Semi-Annually	Lubricate left hand piston. Clean conductivity cell. Check conductivity cell for calibration.

Instrument Maintenance Schedule	
High Pressure Liquid Chromatograph	
Frequency	Maintenance Items
As Needed	<p>Replace guard columns when peak shape and resolution indicate that chromatographic performance of column is below method requirements.</p> <p>Replace column if above does not solve problem</p> <p>Replace sample tubing</p> <p>Backflush column.</p> <p>Call Full Spectrum for any major service.</p>
Daily	<p>Check solvent levels. If adding, verify that solvent is from the same source. If changing, rinse gas and delivery lines to prevent contamination of the new solvent.</p> <p>Check in-line vacuum degasser.</p> <p>Check column temperature</p> <p>Check lamp status</p> <p>Pre-filter samples – as needed</p>

Instrument Maintenance Schedule	
Gas Chromatograph	
Frequency	Maintenance Items
As Needed	<p>Replace septum</p> <p>Clean injector port</p> <p>Clip front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required.</p> <p>Change glass wool plug in injection port and/or replace injection port liner when front portion of capillary column is removed.</p> <p>Detectors: clean when baseline indicates contamination or when response is low.</p> <p>FID: clean/replace jet, replace ignitor.</p> <p>PID: clean lamp window or replace as needed, replace seals.</p> <p>ECD: follow manufacturers suggested maintenance schedule</p> <p>Purge & trap devices: periodic leak checks quarterly, replace/condition traps (when poor response or disappearance of reactive or poorly trapped compounds), Bake trap as needed to correct for high background. Change trap annually, or as needed whenever loss of sensitivity or erratic response or failing resolution is observed.</p> <p>Purge & trap autosamplers: leak check system, clean sample lines, valves.</p>
Daily	<p>Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.</p> <p>Check temperatures of injectors and detectors. Verify temperature programs.</p> <p>Check baseline level with analysis of solvent blanks</p> <p>Check reactor temperature of electrolytic conductivity detector.</p> <p>Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.</p> <p>HP 7673 Autosampler: replace syringe, fill wash bottle, dispose of waste bottle contents.</p>
Semi-Annually	ECD: perform wipe test.

Instrument Maintenance Schedule	
Gas Chromatography/ Mass Spectrometer	
Frequency	Maintenance Items
As Needed	Replace septum Clean injector port Break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance (e.g. peak tailing, poor resolution, high backgrounds, etc.) indicates it is required. Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add or change oil if needed. Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels. Check ion source and analyzer (clean, replace parts as needed) Clean Source, including all ceramics and lenses - as is indicated by a variety of symptoms including inability to properly tune, poor response, and high background contamination. Repair/replace jet separator. Replace filaments when both filaments burn out or performance indicates need for replacement.
Daily	Check baseline level with analysis of solvent blanks. Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks. Autosampler: check for proper operation.
Annually	Replace the exhaust filters on the mechanical rough pump every 1-3 years or as needed

Instrument Maintenance Schedule	
ICP	
Frequency	Maintenance Items
Daily	Check gases Check that argon tank pressure is 50-60 psi. Check vacuum pump gauge. (<10millitorr) Check coolant system. Check the nebulizer. Check the capillary tubing. Check the peristaltic pump and tubing. Check that exhaust screens are clean -- change/clean as needed Check the torch.
Monthly or As Needed	Clean torch assembly. Clean nebulizer and drain. Replace when needed: peristaltic pump tubing sample capillary tubing autosampler sipper probe Check O-rings -- replace as needed Clean/lubricate autosampler tracks.
Semi-Annually	Change vacuum pump oil.
Annually	Replace coolant water filter. (more or less frequently depending on the quality of water) Notify manufacturer service engineer for scheduled preventive maintenance service.

Instrument Maintenance Schedule	
Chemical Oxygen Demand (COD) Reactor	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily (When Used)	Calibrate with check standards.

Instrument Maintenance Schedule	
Cold Vapor Atomic Absorption (Leeman PS 200)	
Frequency	Maintenance Items
As Needed	Change pump tubing Check/change Hg lamp Clean optical cell Lubricate pump
Daily	Change drying tube Check pump tubing/drain tubing Check gas pressure Change Hg lamp intensity Check tubing
Annually	Change Hg lamp – if needed

Instrument Maintenance Schedule	
pH Meter	
Frequency	Maintenance Items
As Needed	Clean electrode. Refill reference electrode.
Daily	Inspect electrode. Verify electrodes are properly connected and filled. Inspect electrode proper levels of filling solutions. Make sure electrode is stored in buffer.

Instrument Maintenance Schedule	
Spectrophotometer	
Frequency	Maintenance Items
As Needed	Dust the lamp and front of the front lens.
Daily (When Used)	Check the zero% A adjustment. Clean sample compartment Clean cuvettes
Weekly	Clean windows
Annually	Check instrument manual. Perform wavelength calibration. Replace lamp annually or when erratic response is observed. Clean and align optics.

Instrument Maintenance Schedule	
Digestion Block	
Frequency	Maintenance Items
Daily or when used	Check temperature with NIST thermometer Document on prep log
As needed	Send for service

Instrument Maintenance Schedule	
Flash Point Tester	
Frequency	Maintenance Items
As Needed	Check thermometer against NIST thermometer, when used.
Daily	Check tubing. Clean sample cup each use. Check gas. Clean flash assembly Check stirrer

Instrument Maintenance Schedule	
Dissolved Oxygen Meter	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily (When Used)	Check probe membrane for deterioration Clean with HCl solution.

Instrument Maintenance Schedule	
Total Organic Halide Analyzer	
Frequency	Maintenance Items
As Needed	Examine and clean or replace pyrolysis tube. Clean titration cell. Observe gas flow. Replace reference electrode fluid. Replace o-rings and seals.
Daily	Check electrodes for damage, polish the electrodes if needed. Replace dehydrating fluid and electrolyte fluid. Clean quartz boat. Observe check valves during use for backfeed. At end of each day of use, wash out absorption module, empty electrolyte and fill cell with DI water. Empty dehydrator tube Perform cell performance check.

Instrument Maintenance Schedule	
Total Organic Carbon Analyzer (DC190)	
Frequency	Maintenance Items
Monthly or As Needed	Rinse catalyst and combustion tubes after 160hr of operation. Check injection port septum after 50-200 runs. Inspect O-rings in TC inlet and bottom connector Sample pump Digestion vessel/condensation chamber Permeation tube after 2000 hours of use – or as needed Check/replace copper/tin scrubber Clean ample loop
Daily	Check: Oxygen supply Acid supply – 1/3 full min. IC chamber ½ full min and acidified IR millivolts for stability (after 30 min. warm-up) Gas supplies - Gas flow at 180-220cc/min Temperature at set point Empty h2o trap
Weekly	Check injection port septum Check for moisture downstream of permeation dryer Inspect TC/IC inlet valve Clean IC reactor
Monthly	Do the leak test

Instrument Maintenance Schedule	
Specific Digital Ion Analyzer	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily (When Used)	Calibrate with check standards. Inspect electrode daily, clean as needed. Inspect electrode proper levels of filling solutions daily, fill as needed Clean probe, each use.

Instrument Maintenance Schedule	
Turbidimeter	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily (When Used)	Adjust linearity on varying levels of NTU standards. Standardize with NTU standards. Inspect cells.
Monthly	Clean instrument housing

Instrument Maintenance Schedule	
Conductance Meter	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily (When Used)	Check probe and cables. Standardize with KCl. Inspect conductivity cell

Instrument Maintenance Schedule	
Sonicator	
Frequency	Maintenance Items
As Needed	Disassemble and clean sonicator probe tips. Replace if cleaning does not fix problem Sonicators in use at STL Los Angeles are self-tuning – send out for service if needed.
Daily (When Used)	Inspect probe tips for inconsistencies (etching/pitting). Check tune and general operation – document in logbook

Instrument Maintenance Schedule	
Analytical/Top Loading Balances	
Frequency	Maintenance Items
Daily	Check using Class S-verified weights once daily or before use – over the range of use Clean pan and weighing compartment
Annually	Manufacturer cleaning and calibration.

Instrument Maintenance Schedule	
Refrigerators/Walk-in Coolers	
Frequency	Maintenance Items
As Needed	Refrigerant system and electronics serviced.
Daily	Temperatures checked and logged. Document out of control events and corrective action

Instrument Maintenance Schedule	
Ovens	
Frequency	Maintenance Items
As Needed	Electronics serviced.
Daily	Temperatures checked and logged. Document out of control events and corrective action

Instrument Maintenance Schedule	
IR Thermometer	
Frequency	Maintenance Items
As Needed	Replace Battery
Daily	Temperatures checked against calibrated mercury thermometer
Quarterly	Calibrated against NIST Thermometer – replace battery before calibration

5.4.3 Equipment Verification and Calibration

All equipment is tested upon receipt to establish its ability to meet the QC guidelines contained in the test method for which the instrumentation is to be used. This testing is documented in instrument run and QA controlled maintenance logbooks.

Once an instrument is placed in routine service, ongoing instrument calibration is demonstrated at the appropriate frequency as defined in the test method. Any instrument that is deemed to be malfunctioning is clearly marked and taken out of service. When the instrument is brought back into control, this is documented in the instrument maintenance log.

5.5 Measurement Traceability

5.5.1 General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, deionized (DI) and reverse osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. The SOP, SANA-QA-0014, *Monitoring and Calibration of Support Equipment* further defines the calibration process, acceptance criteria and application of correction factors for support equipment.

An external certified vendor services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balances are calibrated on each day of use. All Mercury thermometers are calibrated annually and digital thermometers are calibrated quarterly against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

Laboratory DI and RO water systems have documented preventative maintenance schedules and the conductivity (or resistivity) of the water is recorded on each day of use.

Laboratory SOP's specify the required level of accuracy in volumetric glassware. In all cases, volumetric glassware meets the requirements specified in the published test method.

5.5.2 Reference Standards

The receipt of all reference standards is documented. Reference standards are labeled with a unique Standard Identification Number, date received, and the expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All standards should be purchased with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The documentation of standard purity is archived, and references the Standard Identification Number.

All efforts are made to purchase standards that are $\geq 97.0\%$ purity. If this is not possible, the weight of the standard is corrected for the purity when performing calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot or preparation by two different analysts is acceptable for use as a second source. The appropriate QC criteria for specific standards are defined in laboratory SOP's. In most cases, the analysis of an Initial Calibration Verification (ICV) or Laboratory Control Sample (LCS) is used as the second source confirmation.

5.5.3 Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specific in method SOP's. Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the date the reagent was opened are documented. Solvents and acids are verified by one of the STL network laboratories before received at the laboratory according to the procedure described in the corporate SOP, *Quality Testing of Solvents*.

5.6 Sampling

Sample homogeneity and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAP's and/or QAPP's are in place, they must be made available to the Laboratory and approved by the Laboratory Management before sample receipt.

5.7 Sample Handling, Transport, and Storage

5.7.1 General Chain of Custody

Chain of Custody (COC) can be established either when bottles are sent to the field, or at the time of sampling. STL can provide all of the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

Samples are received at the laboratory by designated sample receiving staff and a unique Laboratory Project Identification Number is assigned. The following information is recorded for each sample shipment: Client/Project Name, Date and Time of Laboratory Receipt, Laboratory Project Number, sample collector's name (if available), and Signature or initials of the personnel receiving the cooler and making the entries.

Upon inspection of the cooler and custody seals, the sample custodian opens and inspects the contents of the cooler, and records the cooler temperature. All documents are immediately inspected to assure agreement between the test samples received and the COC.

Any nonconformance, irregularity, or compromised sample receipt as described in Section 4.7.1 is documented and brought to the immediate attention of the PM for resolution with the client and documented using the electronic NCM system, *Clouseau*. The COC, shipping documents, documentation of any nonconformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the permanent project record.

Samples that are being tested at another STL facility or by an external subcontractor are repackaged, iced, and sent out under a formal COC. Following sample labeling as described in Section 5.7.2, the sample is placed in storage. Sample storage is required to be access controlled. All samples are stored according to the requirements outlined in the test method, and in a manner such that they are not subject to cross contamination or contamination from their environment. Unless specified by method or state regulation, a tolerance range of $4 \pm 2^{\circ}\text{C}$ is used. Sample storage temperatures are monitored daily.

5.7.2 Sample Identification and Traceability

Each sample container is assigned a unique Sample Identification Number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a sample identification label. Access to samples is controlled and documented, identifying the identity of the sample handler, and date and time of sample access.

The laboratory utilizes a custom designed Laboratory Information Management System (LIMS) to uniquely identify and track samples and analytical data throughout the facility. The laboratory additionally maintains a master log of all COC's received and internal chain-of-custody printouts as backup. Detailed instructions on the log-in and receipt procedures can be found in the *Sample Receipt and Sample Handling SOP's*. The following information is entered into the LIMS:

- Quote number (a project template generated by the PM)
- Sample number (a sequential 6 digit number)
- Date received
- Date analytical results due
- Sample description
- Client's name and address
- Client's job number (if available)
- Billing information – purchase order numbers
- Analyses requested
- Notation of special handling instructions
- Project-specific comments

This information then becomes the Project Receipt Records. Once these records are generated, method-specific analytical worksheets from LIMS are generated for distribution to the appropriate analysts along with the sample receiving information. A secondary review of the project receipt records is carried out by the PM to ensure compliance with project requirements.

All unused portions of samples, including empty sample containers, are returned to the secure sample control area. Upon client request, where possible, access to all legal samples and subsamples is controlled and documented. The laboratory area is considered a secured area and is restricted to authorized personnel only.

5.7.3 Sample Preparation

Holding times for every analysis are established in the method SOP's or on a project specific basis. Holding times are tracked throughout the facility using the LIMS and the NCM database. Work is scheduled by Department Managers to avoid expiration of any sample prior to analysis. If any holding times are not met, the laboratory informs the Project Manager as soon as possible and the Project Manager notifies the client. Depending on the nature of the holding time violation, an NCM is created.

Samples are prepared according to standardized methods. Batches are generated in the prep lab according to preparation method, analytical method, and matrix. In general, batches do not exceed 20 field samples of the same matrix and are defined as samples prepared at the same time. Subsampling to ensure representativeness is described in the *Subsampling* SOP.

Inorganics (Metals and Wet Chemistry) - Samples for analyses are prepared in batches containing a maximum of 20 samples of the same or similar matrix. A Method Blank and Laboratory Control Sample are digested with each batch. A Matrix Spike and Matrix Spike Duplicate analyses are performed for every 20 samples of the same matrix.

Organics - Samples for organics analyses are prepared in batches containing a maximum of 20 samples of the same or similar matrix. The organic extraction labs are equipped for handling many matrices and various clean-up requirements including silica gel, acid-base, and sulfur. A Method Blank is performed with each batch. Lab Control Samples are extracted with each batch for applicable methods. Matrix Spike and Matrix Spike Duplicate analyses are performed for every 20 samples of the similar matrix given sufficient sample volume.

Repreparation - Repreparation or re-analysis of a sample may be required in cases of contamination, missed dilution, low surrogate recovery, etc. If the need for reanalysis/re-preparation has been determined, the request is forwarded to the appropriate department using the electronic NCM process.

Screening - Samples for organics analyses are screened prior to analysis and/or extraction. Screening helps to prevent unnecessary re-runs and lower instrument recalibration, retune and analyst labor time. In general, all GC/MS volatiles are screened prior to analysis by another GC/MS at a 50X dilution.

If necessary, soil semi-volatiles are pre-screened prior to extraction to determine if they require low or medium level extraction procedures. If necessary, all semi-volatile extracts are screened prior to analysis using GC with FID detectors. Similarly, all pesticide/PCB extracts are screened prior to analysis using GC with ECD detectors.

5.7.4 Sample Storage and Disposal

Samples are stored according to preservation protocols and per method or manufacturer's guidelines. Samples are stored away from standards, reagents, and potentially contaminating sources in such a manner as to prevent cross contamination.

Samples are retained in STL storage facilities for 45 days after the project report is sent unless prior written arrangements have been made with the client. Samples may be held longer or returned to the client per written request. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

Samples are disposed of in accordance with federal, state and local regulations. STL has Waste Disposal SOP's detailing the disposal of samples, digestates, and extracts. Sample and extract disposal is carried out following applicable state and federal guidelines. A discussion of the storage and disposal procedures for laboratory waste generated at the laboratory is found in the *Hazardous Waste Disposal SOP*.

5.8 Assuring the Quality of Test Results

5.8.1 Proficiency Testing

STL analyzes Proficiency Test (PT) samples as required for certification and as outlined in the National Environmental Laboratory Accreditation Conference (NELAC). STL participates in the PT program semi-annually or as required for each area of testing and matrix (e.g. organics, inorganics; aqueous and drinking water) for which the laboratory is accredited. There are no PT programs governing the air tests at this time.

PT samples are handled and tested in the same manner (procedural, equipment, staff) as environmental samples. PT test sample data are archived using the same requirements for project and raw data record retention. STL participates in a number of PT programs as depicted in Table 13

STL also participates in a double blind performance. An external vendor is contracted by the Corporate QA Director to submit double blind samples to the laboratory. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the Corporate QA Director and to each of the STL facilities.

5.8.2. Control Samples

Control samples are analyzed with each batch of samples to monitor laboratory performance in terms of accuracy, precision, sensitivity, selectivity, and interferences. Each control sample has a unique identifier that directly relates it to a preparation/analytical batch. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

There are also a number of QC types that monitor field sampling accuracy, precision, matrix effect, representativeness, and interferences on the method performed. Control Sample types and typical frequency of their application are outlined in Table 13. Note that the frequency of control samples vary with specific regulatory, methodology and project specific criteria.

Table 13. Laboratory Intercomparison Proficiency Testing Studies

PE Program Description	Matrix	Analyses Performed	Purpose	Frequency
Environmental Resource Associates (ERA) Water Supply*	Drinking Water	Metals, wet chemistry, volatile & semivolatile organics & PCBs	NELAP Accreditation	Semiannual
ERA Water Pollution*	Waste Water	Metals, wet chemistry, volatile & semivolatile organics & PCBs	NELAP Accreditation	Semiannual
ERA Soil Study	Solid	Metals, Pesticides, PCBs, Cyanide, Semivolatiles, and Volatiles	NELAP Accreditation	Semiannual
Discharge Monitoring (DMR)	Waste Water	Metals and classical chemistry	NPDES Permit Holders	Annual
US Army Corps of Engineers (ACOE)	Aqueous Soil	Metals, wet chemistry, volatile & semivolatile organics & PCBs	ACOE Approval	Per 18 months
Environmental Resource Associates (ERA) UST	Aqueous Soil	TPH and TRPH (State of Alaska Method)	Alaska & Wash. State UST	Semiannual
ERA for SHELL Co.	Aqueous	Metals, wet chemistry, volatile & semivolatile organics & PCBs	Client Approval	Annual
ASI for Honeywell	Aqueous Soil	Metals, wet chemistry, volatile & semivolatile organics & PCBs	Client Approval	Annual
STL Corporate Double-blind PE	Aqueous	Metals, wet chemistry, volatile & semivolatile organics & PCBs	Corporate-wide QA Monitoring	Annual
Client Double-blind PE	Aqueous Soil	Metals, wet chemistry, volatile & semivolatile organics & PCBs	Client Approval	Annual

The quality control program implemented in the laboratory includes the analysis of Method Blanks, Calibration Check Standards, Laboratory Control Samples, Matrix Spikes, Matrix Spike Duplicates, Sample Duplicates and Surrogate Spikes. Depending on the analysis, every analytical series includes one or more of these controls. Table 14 provides a brief summary of the frequency and control limits for the fundamental quality control measures performed for analyses by the laboratory.

Additional types of quality control are performed as necessary. The QA policy, QA-SANA-002, *Quality Control Program* provides a detailed description of the routine analytical quality control activities including the types and frequencies of control samples and their assessment to determine acceptability of sample test results. The QA SOP, SANA-QA-0002, *Statistical Evaluation of Quality Control Data and Development of Control Charts*, defines who is responsible for documenting QC acceptance criteria.

Table 14. Quality Control Samples

QC Sample Type	Use	Typical Frequency
Laboratory Control Sample (Laboratory Fortified Blank)	Measures accuracy of method in blank matrix	1 per batch of 20 or less samples per matrix type per sample extraction or preparation method
Method Blank	Measures method contribution to any source of contamination	1 per batch of 20 or less samples per matrix type per sample extraction or preparation method
Instrument Blank	Measures instrumental contribution to any source of contamination	As specified in test method
Cleanup Blank	Measures clean up step contribution to any source of contamination	As specified in test method
Holding (Storage) Blank	Measures storage contribution to any source of contamination (Voa only)	Every week
Matrix Duplicate (unspiked duplicate)	Measures effect of site matrix on precision of method	Per SAP/QAPP
Matrix Spike	Measures effect of sample matrix on accuracy of method	Per SAP/QAPP
Matrix Spike Duplicate	Measures effect of sample matrix on precision of method	Per SAP/QAPP
Equipment Blank (Equipment Rinsate)	Measures field equipment contribution to any source of contamination	Per SAP/QAPP
Trip Blank	Measures shipping contribution to any source of contamination (Volatiles only)	Per Cooler
Field Blank	Measures field environment contribution to any source of contamination	Per SAP/QAPP
Field Duplicate	Measures representativeness of sampling and effect of site matrix on precision	Per SAP/QAPP

Table 15. Frequency and Control limits for QC Measures

Parameter	QC type	Frequency	Control Limits	Corrective Action
Volatile Organics	Method Blank	1 per batch	target analytes \leq RL; 5XRL exception for common lab contaminants (MeCL, Acetone, 2-Butanone)	system check, reanalysis of associated samples
	Surrogate spike	each sample standard, blank	In-house limits	review, reanalyze based on technical judgment
	MS/MSD	set per 20 samples per matrix	In-house limits	report results
	LCS	1 per batch	In-house limits	review, reanalyze LCS and associated samples, if needed
Semi-volatile Organics	Method Blank	1 per 20 samples or each batch	\leq RL; 5XRL exception for common lab contaminants (Phthalate esters)	reanalysis, if still out, reextract w/ samples
	Surrogate spike	each sample, standard, blank	In-house limits	review, re-extract based on technical judgment
	MS/MSD	set per 20 samples / matrix	In-house limits	report results
	LCS	1 per 20 samples or each batch	In-house limits	review, reextract w/samples, if appropriate
Extractable Organics	Method Blank	1 per 20 samples or each batch	\leq RL	reanalysis, if still out, reextract w/samples
	Surrogate spike	each sample, standard, blank	In-house limits	review, reextract based on technical judgment
	MS/MSD	set per 20 samples per	In-house limits	report results
	LCS	1 per 20 samples or each batch	In-house limits	review, reanalysis or reextract w/samples, if appropriate
Metals	Method Blank	1 per 20 samples or batch	\leq RL; 2XRL exception for common lab contaminants (Cu, Zn, Fe, Pb)	redigest batch
	LCS	1 per batch	In-house limits	redigest batch
	MS	1 per 20 samples per matrix	In-house limits	flag results
	MSD	1 per 20 samples per matrix	In-house limits	flag results
Wet Chemistry	Method blank	1 per 20 samples or batch	\leq RL	system check, reanalysis of batch
	LCS	1 per batch	In-house limits	system check, reanalysis of batch
	MS	1 per 20 samples per matrix	In-house limits	flag results
	MSD	1 per 20 samples per matrix	In-house limits	flag results

RL = Reporting Limit

5.8.3 Establishing QC Acceptance Limits

For new procedures, published method limits can be used until sufficient QC data are acquired (minimum of 20 to 30 data points recommended). However, the published limits may not be appropriate if they are based on a single-operator or single-laboratory study. In this case, the QA staff may establish default limits until enough data are collected for laboratory established limits to be determined.

For existing procedures, data collected over several months to a year or more can be used. Control tables or control charts are used together with the calculated mean and standard deviation to determine if the data set being considered is free of trends and are representative. If it appears that the data include gross outliers, outlier tests such as the Grubbs Test, Dixon Test (for 20 or fewer data points), or Rule-of-Huge-Error Test can be used to justify eliminating individual data points. Laboratory established limits must be reevaluated at least annually.

5.8.3.1 Calculating Laboratory Statistical Performance

Accuracy: mean recovery $\pm 3s$

Precision: zero to (mean RPD + 3s)

Where: s is standard deviation

If there are insufficient sample surrogate recovery data available to calculate limits, method limits may be used, if available. For methods, matrices, and/or analytes with very limited data, interim limits should be established using available data or by analogy to similar methods or matrices.

5.8.3.2. Setting Control Limits

The working control limits to be used by the laboratory are based on evaluation of the calculated laboratory statistical performance and available inter-laboratory limits provided in the reference methods. Certain analytical methods (e.g., E524.2, E624, and E625) regulated by the CWA and SDWA specify QC acceptance criteria. In these cases, method-specified limits are used.

The control limits should be evaluated for systematic trends and consistency of the performance of the analytical procedure at least annually or whenever new patterns of performance are observed in the laboratory data (i.e. new methods, equipment, etc.). When evaluating current "laboratory-generated limits" against historical "laboratory-generated limits", the laboratory QA manager should investigate any significant changes in "laboratory-generated mean" and "laboratory-generated range" and should attempt to identify the cause before making any changes to the laboratory limits. If the recalculated limits are consistent with the historical limits, the historical limits may remain unchanged. QC limits are never set narrower than the calibration criteria specified by the method.

5.8.3.3. QC Limits as an Estimate of Uncertainty

In-house, method-specific, historical control limits for the LCS are used to define the Estimate of Uncertainty for a method. As the estimate of uncertainty, the LCS control limits potentially represent tighter QC criteria than one that uses real world sample data (MS/MSD). Historical control limits are updated annually and represent a data set comprised of a minimum of 20 data points.

Current method specific control limits are available upon request and are part of STL's standard reporting protocol. If needed, client specific sample limits for MS/MSD's can be generated, if there are enough data points, for project specific use.

5.8.3.4. Reporting QC Data

The QC data routinely reported includes the LCS, Method Blank and Surrogate standards. Matrix QC are reported on a project or client basis, and clients are encouraged to identify on the custody forms specific samples to be used for matrix spiking. Client reporting requirements are negotiated and documented as part of the project records. Ultimately, all reporting decisions should accommodate the client's requirements.

5.8.4. Calibration

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the calibration range established for the analytical method. Method-specific SOP's discuss in detail how each instrument is calibrated, including frequency for calibration and recalibration, and the source or grade of the calibration materials. The range of analyses performed and instrumentation utilized is extensive and the calibration procedures are instrument specific, varying from analysis to analysis. The corporate QA policy *Selection of Calibration Points* will be followed in determining the appropriate number of calibration points in the absence of guidance from analytical methods.

The calibration procedures for organics usually include an initial system performance check (i.e., tune) and some type of initial calibration (a minimum of five calibration standards for most methods) with each analytical series. With each new initial calibration, an independent standard from a different source is also analyzed to ensure the accuracy of the calibration standards. Ongoing and closing calibration checks are also included in most analytical series to verify the consistency of the calibrations. For each type of calibration standard or performance check there are specific criteria to meet before sample analyses begin. These criteria are established in the methodologies as they are written in the referenced texts or by contract specifications.

In general, the instrument is then calibrated for all target compounds. An initial calibration curve is produced to define the working range to establish criteria for identification. Each new multi-point calibration is then verified using standards from an independent source. This initial calibration is also evaluated on a daily basis to ensure that the system is within calibration. If the daily standard does not meet the established criteria, the system is recalibrated.

Gas Chromatography/Mass Spectrometry (GC/MS) - Prior to analysis of samples, the instrument is tuned with Bromofluorobenzene (BFB) for volatile compounds and Decafluorotriphenyl-phosphine (DFTPP) for Semivolatile compounds or other tune criteria as specified by the method used. No samples are analyzed until the instrument has met the tuning criteria of the method.

Gas Chromatography - Each chromatographic system is calibrated prior to performance of analyses. Initial calibration consists of determining the working range, establishing limits of detection, and establishing retention time windows. Each new multi-point calibration is then verified using standards from an independent source. The calibration is also checked as required to ensure that the system remains within specifications. In addition, continuing calibrations are performed at frequencies required by the method used. If the calibration checks do not meet established criteria, corrective action which may include recalibration and reanalysis of samples is taken.

Metals - Analysis for metals involves one types of analytical instrumentation: inductively coupled argon plasma emission spectroscopy (ICP-AES).

Each ICP-AES is calibrated prior to use by analyzing a multi-element calibration standard. The calibration is then verified using standards from an independent source. A linear range verification check standard is analyzed and reported annually for each element analyzed by ICP. This concentration is the upper limit of the ICP linear range and any result found above this limit must be diluted and reanalyzed. The calibration is monitored throughout the day by analyzing a Continuing Calibration Blank (CCB) and a Continuing Calibration Verification Standard (CCV). If the verification standard does not meet established criteria, corrective action is performed.

The method of standard additions or sample dilution is used when the single spike analysis indicates matrix interferences are present.

Wet Chemistry - The field of classical (wet) chemistry involves a variety of instrumental and wet chemical techniques. Calibration and standardization procedures vary depending on the system and analytical methodology required for a specific analysis. The calibration is checked on an ongoing basis to ensure that the system remains within specifications. If the ongoing calibration check does not meet established criteria, analysis is halted and corrective action is taken. The procedures include examination of instrument performance and recalibration and reanalysis of samples back to the previous acceptable calibration check.

The acceptable practices for maintaining time integrity and manual integrations are described in detail in the QA Policy *Maintaining Time Integrity* and the Corporate SOP, *Acceptable Manual Integration Practices*. Manual Integration Training is conducted on an annual basis. All Associates who generate, upload, review, release or report data must undergo training. A test is given at the end of the PowerPoint training with a score of 90% deemed acceptable.

5.8.5. Procedure for Permitting Departures from Documented Procedure

Where a departure from a documented SOP, test method, or policy is determined to be or perceived to be necessary, or is unavoidable, the departure is documented through the nonconformance process as described in Sections 4.9 and 4.10. The departure from procedure must be reviewed and authorized by the QA Manager and the department supervisor.

Where a departure affects a specific client project, the PM must be informed of the deviation. In some instances, it is appropriate to inform the client before permitting a departure. Any such occurrence is documented in the cover letter and/or project narrative.

5.9. Project Reports

5.9.1. General

The criteria described in Section 5.9.2 apply to all Project Reports that are generated under NELAC requirements. The criteria described in Section 5.9.3 and 5.9.4 apply to all Project Reports.

5.9.2. Project Report Contents for NELAC Projects

- Title
- Laboratory name, address, telephone number, contact person
- Unique Laboratory Lot Number
- Total Number of Pages (report must be paginated)
- Name and address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- Client Sample Identification
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date
- Definition of Data Qualifiers
- Reporting Units
- Test Method
- Laboratory certification that the test results meet all applicable NELAC requirements or provide justifications if they do not

The following are required where applicable to the specific test method or matrix:

- Solid Samples: Indicate Dry or Wet Weight
- If holding time < 48 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the reporting limit.

5.9.3. Project Narrative for All Project Types

A Project Narrative and/or Cover Letter is included with each project report and at a minimum includes an explanation of any and all of the following occurrences:

- Analytical nonconformances
- "Compromised" sample receipt (see Section 4.7.1)
- Method Deviations
- QC criteria failures

5.9.4. Project Release

The Laboratory Project Manager authorizes the release of the project report with a signature.

Where amendments to project reports are required after issue, these shall be in the form of a separate document and/or electronic data deliverable. The revised report is clearly identified as "revised" with the date of revision and the initials of the person making the revision. Specific pages of a project report may be revised using the above procedure with an accompanying cover letter indicating the page numbers of the project revised. The original version of the project report must be kept intact and the revisions and cover letter included in the project files.

5.9.5. Subcontractor Test Results

Subcontracted data are clearly identified as such, and the name of the laboratory performing the test is included in the project report.

Subcontracted results from laboratories external to STL are not reported on STL report forms or STL letterhead. Test results from more than one STL facility are clearly identified with the name of the STL facility that performed the testing, address, and telephone number for that facility.

5.9.6. Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of STL's services. STL offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the Corporate IT department by the PM for review and undergo the contract review process in Section 4.4.1. Once the facility has committed to providing diskettes in a specific format, the coding of the format is performed. This coding is documented and validated. The validation of the code is retained as a QC record. EDD's are subject to a secondary review to ensure their accuracy and completeness.

5.9.7. Project Report Format

STL offers a wide range of project reporting formats, including CD-ROM, EDD's, short report formats, and complete data deliverable packages suitable for validation. More information on the range of project reports available can be obtained by contacting the STL facility. Regardless of the level of reporting, all projects undergo the same levels of review as described in Section 5.3.6.

Appendix A: Analytical Methodologies Performed at STL Los Angeles

Reference	Method	Description
40CFR136	624	GC/MS Volatile Organics (limited target list)
40CFR136	625	GC/MS Semivolatile Organics (limited target list)
40CFR141	524.2	GC/MS Volatile Organics, Drinking Water
ASTM	D1945	Natural Gas in Air
ASTM	D1946-90	Fixed Gases in Air
ASTM	D3416	Total Carbon, Total Non-methane Organic Carbon (TNMOC)
CAA	TO3	Volatile Organic Compounds in Ambient Air by GC
CAA	TO14A	Volatile Organic Compounds in Ambient Air by GCMS
CAA	TO15	Volatile Organic Compounds in Ambient Air by GCMS
EPA	1664A	Hexane Extractable Material
EPA	15/16	Sulfur Compounds in Air
EPA	25 Mod/25C Mod	Total Non-methane Organic Carbon (TNMOC)
EPA SW-846	1010	Ignitability (F)
EPA SW-846	1311	Toxicity Characteristic Leaching Procedure (TCLP)
EPA SW-846	1312	Synthetic Precipitation Leaching Procedure (SPLP)
EPA SW-846	6010B	ICP Metals
EPA SW-846	6010B TCLP	ICP Metals, TCLP Leachate
EPA SW-846	7196A	Hexavalent Chromium
EPA SW-846	7199A	Hexavalent Chromium
EPA SW-846	7470A	Mercury by Cold Vapor
EPA SW-846	7471A	Mercury by Cold Vapor
EPA SW-846	8015B Mod GRO	TPH- Gasoline
EPA SW-846	8015B Mod DRO	TPH- Diesel
EPA SW-846	8021B	GC Aromatic Volatile Organics
EPA SW-846	8081A	Organochlorine Pesticides
EPA SW-846	8081A TCLP	TCLP Organochlorine Pesticides
EPA SW-846	8082	GC PolyChlorinated Biphenyls
EPA SW-846	8082 TCLP	TCLP GC PolyChlorinated Biphenyls
EPA SW-846	8260B	GC/MS Volatile Organics
EPA SW-846	8260B TCLP	TCLP GC/MS Volatile Organics
EPA SW-846	8260B	GC/MS Low Level Volatile Organics
EPA SW-846	8270C	GC/MS Semivolatile Organics
EPA SW-846	8270C TCLP	TCLP GC/MS Semivolatile Organics
EPA SW-846	9010B/9014	Cyanide
EPA SW-846	9056	Inorganic Anions by Ion Chromatography

Reference	Method	Description
EPA SW-846	9060	Total Organic Carbon
EPA SW-846	9040B	pH (std. units)
EPA SW-846	9045C	Soil pH (std. Units)
EPA SW-846	9050	Conductivity
In-house SOP	RSK-175	Dissolved Gases in Groundwater
MCAWW	160.3 Mod	Percent Solids
MCAWW	120.1	Conductivity
MCAWW	150.1	pH (std units)
MCAWW	160.1	Total Dissolved Solids
MCAWW	160.2	Total Suspended Solids
MCAWW	160.3	Total Solids
MCAWW	160.4	Volatile Total Solids
MCAWW	160.5	Settleable Solids (ml/hr.)
MCAWW	180.1	Turbidity (NTU)
MCAWW	200.7	Metals
MCAWW	300.0A	Inorganic Anions by Ion Chromatography
MCAWW	310.1	Alkalinity (as CaCO ₃)
MCAWW	340.2	Fluoride
MCAWW	350.3	Ammonia Nitrogen by ISE
MCAWW	360.1	Oxygen, dissolved
MCAWW	376.2	Sulfide
MCAWW	405.1	BOD5
MCAWW	410.4	COD
MCAWW	415.1	Total Organic Carbon
MCAWW	425.1	MBAS
MCAWW	245.1	Mercury by Cold Vapor
MCAWW	335.1, 335.2	Cyanide, Total and Amenable
Standard Methods	2130B	Turbidity
Standard Methods	2320B	Alkalinity (as CaCO ₃)
Standard Methods	2340B	Hardness
Standard Methods	2510B	Conductivity
Standard Methods	2520B	Salinity
Standard Methods	2540C	Total Dissolved Solids
Standard Methods	2540D	Total Suspended Solids (TSS)
Standard Methods	2540F	Settleable Solids
Standard Methods	2540G	Total Solids
Standard Methods	3500FE	Ferrous Iron (Phenanthroline Method)
Standard Methods	4500S-D	Sulfide
Standard Methods	4500CNG/CNE/CNI	Cyanide, Total and Amenable, weak Acid Dissociable
Standard Methods	4500FC	Fluoride by Ion Selective Electrode
Standard Methods	4500NH ₃ -F	Ammonia
Standard Methods	5210B	BOD
Standard Methods	5220D	COD
Standard Methods	5520C	Oil & Grease by IR
Standard Methods	5520CF	TRPH by IR
SCAQMD	25.1	Non-condensable gas
Method of Soil Analysis	Walkley-Black	Total Organic Carbon (soil)

Appendix B: List of Certifications and Accreditations

Regulatory Agency	Cert No.	Drinking Water (SDWA)	Waste Water (CWA)	Solid/Hazardous Waste	UST Programs	Air Toxics (CAA)
Alaska-DEC ¹	UST-043	NR	--	--	08/13/96 07/03/05E	--
California-ELAP ^{1,3}	CA-2092	10/10/95 10/31/05E	10/10/95 10/31/05E	10/10/95 10/31/05E	10/10/95 10/31/05E	--
California - NELAC ^{1,3}	01118CA	01/24/01 01/24/06	01/24/01 01/24/06	01/24/01 01/24/06	--	--
Colorado ²	N/A	11/30/96 02/28/06E	--	--	--	--
Florida - NELAC ^{1,3}	N/A	--	--	--	--	01/24/01 06/30/05E
Kansas- NELAC ^{2,3}	E-10343	12/26/01 01/31/06E	12/26/01 01/31/06E	12/26/01 01/31/06E		
Louisiana NELAC ^{2,3}	01948	--	11/98 06/30/05E	11/98 06/30/05E	11/98 06/30/05E	--
Maryland ²	258	4/10/96 06/30/04E	--	--	--	--
Washington-DOE ²	C-217	--	08/02/96 01/29/05E	08/02/96 01/29/05E	08/02/96 01/29/05E	--
LA County Sanitation District ¹	10238	--	08/16/94 N/A	--	--	--
USDA Permit To Move Soil ¹	S-4390	--	--	03/31/06E	--	--
US Air Force Center for Environmental Excellence (AFCEE)	N/A	Project specific	Project specific	Project specific	--	Project specific
US Naval Facilities & Engineering Center (NFESC) ¹	N/A	06/08/99 03/01/06E	06/08/99 03/01/06E	06/08/99 03/01/06E	--	--
US Army Corps of Engineers (ACOE - HTRW) ^{1,4}	N/A	--	--	--	--	12/31/01 12/31/05E (TO-14 / TO-15)

1 Formal accreditation program based on on-site evaluations and PE.

2 Based on a reciprocity agreement

3 NELAC-authorized Accrediting Agency

4 ACOE HTRW grants an automatic 6-month extension for existing projects.

E Denotes dates of expiration. (if available)

-- A formal program is not in place

Appendix C: List of Standard Operating Procedures

SOP #	Title
AIR TOXICS LABORATORY	
COI-QA-0001	Sample Receiving, Log In, and Internal COC
COI-QA-0005	Releasing and cleaning of Sample Canisters and Cleaning, Calibration and setting of Flow Regulators and Vacuum Gauges
COI-GC-0001	Determination of Total Petroleum Hydrocarbons & BTEX TO-3 / Carb 410
COI-GC-0005	Sample Preparation and the Determination of Dissolved Gasses in Water by Using GC Headspace Equilibration Technique (RSKSOP-175)
COI-GC-0009	Determination of Fixed Gases (Reformed Gas) by Gas Chromatography - EPA Method 3C and ASTM Method D1946-90
COI-GC-0011	Determination of Total NMOC by Method 25 C modified
COI-GC-0012	Determination of Total Volatile Hydrocarbons in Air by GC-FID (ASTM D3416)
COI-GC-0014	Determination of Volatile Sulfur Compounds from Stationary Sources Using EPA Methods 15 & 16
COI-MS-0003	Determination of volatile Organics in Ambient Air by GC/MS - Scan Mode EPA Methods TO-14/TO-14A
COI-MS-0007	The Determination of Low Level Volatile Organics (VOC's) in Ambient Air by GC/MS (Scan mode TO-15)
COI-MS-0008	The Determination of Low Level Volatile Organics (VOC's) in Ambient Air by GC/MS (SIM mode TO-15)
ENVIRONMENTAL HEALTH & SAFETY	
SANA-EHS-001	Waste Characterization, categorization, collection, accumulation, storage, disposal and inspection
SANA-EHS-0003	Waste Minimization
SANA-EHS-0006	Hazardous Waste Spill Response
ORGANIC EXTRACTIONS	
SANA-OP-0001	Extraction of TEPH Hydrocarbons (SW8015B and CA LUFT)
SANA-OP-0004	Glassware Washing for Organic Analysis
SANA-OP-0006	Sonicator Tuning
SANA-OP-0012	Hexane Extractable Material (HEM/SGT-HEM) by Method 1664
SANA-OP-0014	Extraction Cleanup of Organics waters and soils SW846 3500/3600
INORGANIC PREPARATION	
SANA-IP-0001	Acid Digestion of Aqueous Samples, SW 846 MCAWW 200 Series Methods
SANA-IP-0002	Acid Digestion of Soils, SW 846 Method 3050B
SANA-IP/OP-0001	Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure
SANA-IP/OP-0005	WET Test Based on California Code of Regulations (CCR) Title 22 and 26

SOP #	Title
METALS	
SANA-MT-0006	Glassware Washing for Metals / Inorganics Groups
SANA-MT-0007	ICP-AES, Spectrometric Method for Trace Element Analysis sw846 6010B and EPA 200.7
SANA-MT-0008	Prep & Analysis of Hg in Aqueous Samples by 7470 245.5
SANA-MT-0009	Prep & Analysis of Hg in Solid Samples by 7471A MCAWW 245.5
QUALITY ASSURANCE	
QA-SANA-001	Customer Complaint Policy
QA-SANA-002	STL LA Quality Control Program
QA-SANA-003	Soil Holding Time Requirements for Wet Chemistry Tests
QA-SANA-004	Rounding and Significant Figures
QA-SANA-010	Maintaining Time Integrity
QA-SANA-011	Report Revision
SANA-QA-0002	Statistical Evaluation of Quality Control Data and Control Charts
SANA-QA-007	Standards Prep, Traceability and Verification
SANA-QA-0010	Technical and Compliance Assessment of Analytical Data
SANA-QA-011	Supplemental Requirements for Navy Work
SANA-QA-0012	QuantIMS Reference Data Creation and Maintenance
SANA-QA-0014	Monitoring and Calibration of Lab Support Equipment
SANA-QA-0016	Employee Orientation Program
SANA-QA-0017	Laboratory Systems Evaluation
SANA-QA-0018	Nonconformance and Corrective Action
SANA-IT-0001	Software and Hardware Licensing, Security and Backup.
CORPORATE QA SOP's & POLICIES	
P-T-001	Selection of Calibration Points
S-E-001	Procedures for Shipping Samples and Kits
S-Q-001	Official Document Control and Archive

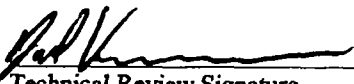
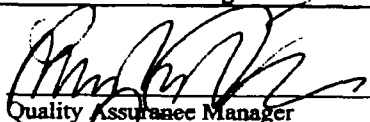
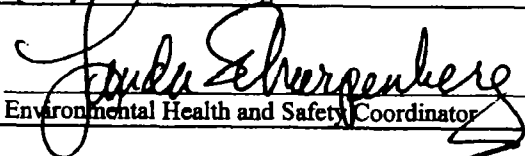
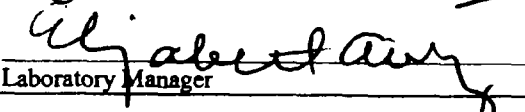
SOP #	Title
S-Q-002	Systems Audit
S-Q-003	Method Detection Limit Studies
S-Q-004	Acceptable Manual Integration Practices
S-T-001	Testing of Solvents and Acids
S-T-002	Reporting Limits for STL Laboratories using QuantIMS
SAMPLE CONTROL	
SANA-SC-0001	Sample Log-In
SANA-SC-0004	Coolers, Containers, and Trip Blanks
SANA-SC-0011	Certification of Laboratory-Supplied Field Blank Water
SANA-SC-0015	Determination of Matrices, Phases, Compositing, and Subsampling
WET CHEMISTRY	
SANA-WC-0001	TOC Catalytic Oxidation using EPA Method 415.1 and SW9060
SANA-WC-0002	Ammonia as N by Ion Selective Electrode EPA 350.3 and SM4500 NH3 F
SANA-WC-0003	Cyanide Total Amenable, Weak Acid Dissociable by SW9010B/9014, E335.1 & .2 SM4500CN E 1
SANA-WC-0004	Determination of Inorganic Anions by IC 300.0 and SW9056
SANA-WC-0005	Fluoride by Ion Selective Electrode Methods EPA 340.2 & SM 4500F-C
SANA-WC-0006	Deionized Water Leachate Procedure for Solid samples
SANA-WC-0007	Turbidity by Nephelometry EPA 180.1 and SM2130B
SANA-WC-0008	Alkalinity by Titration Method SM2320
SANA-WC-0009	Determination of Hexavalent Chromium in Water by IC EPA 218.6 and SW7199
SANA-WC-0012	Chemical Oxygen Demand By 410.4 and SM 5220-D
SOP #	Title
SANA-WC-0016	BOD by EPA405.1 SM5210 & DO by EPA 360.1/SM4500-OG
SANA-WC-0019	Hexavalent Chromium by EPA Method Sw7196A
SANA-WC-0020	Paint Filter Liquids Test for Solid Samples

SANA-WC-0023	Total and/or Dissolved Sulfide 376.2 and SM4500-S2 D
SANA-WC-0024	Ignitability of Solids for Waste Characterization SW846 Chp. 7, Sec. 7.1
SANA-WC-0025	Flashpoint by Pensky Martens Closed Cup Method 1010 ASTM D93-90
SANA-WC-0026	Settleable Solids by EPA 160.5 and SM2540F SW9060
SANA-WC-0030	Specific Conductance (Methods SW846-9050A, EPA 120.1, SM2510B)
SANA-WC-0032	Ferrous, Iron, Phenanthroline Method (SM 3500-FE D)
SANA-WC-0033	Percent Organic Carbon by Walkley Black-Titration
SANA-WC-0034	Total and/or Dissolved Sulfide (376.1 and SM 4500S2- E
SANA-WC-0035	Phosphorous, All Forms by EPA 365.3
SANA-WC-0036	Total Organic Halides in Water by SW-846 Method 9020B
SANA-WC-0037	pH in Waters, Wastes, soils using E150.1, SW9040B and SW9045C
SANA-WC-0038	Determination of Moisture content of soil samples 160.3
SANA-WC-0039	Determination of Solids in Waters and Wastes
SANA-WC-0040	Alkaline Digestion for Hexavalent Chromium in Soil by 3060A
Organic GC and GC/MS	
SANA-GC-0001	Volatile Organics by EPA Method 504.1
SANA-GC-0007	GC analysis based upon EPA 8000 series – 8015, 8021, 8081 and 8082
SANA-GC-0010	PAH's by HPLC – EPA Method 8310
SANA-MS-0006	Determination of Volatile Organics by GC/MS – EPA 8260
SANA-MS-0007	Determination of Semi-Volatile Organics by GC/MS – EPA 8270

Appendix D: STL Los Angeles Essential QA Documents Referenced in the LQM

<u>Plans</u>	<u>Title</u>	<u>LQM Section</u>
QMP	Quality Management Plan	Throughout the LQM.
<u>Policies</u>	<u>Title</u>	<u>LQM Section</u>
QA-SANA-001	Customer Complaints	4.8
QA-SANA-002	STL LA Quality Control Policy	5.8.2
QA-SANA-010	Maintaining Time Integrity	5.8.4
P-T-001	Selection of Data Points for an ICAL	5.8.4
<u>SOP's</u>	<u>Title</u>	<u>LQM Section</u>
SANA-QA-0007	Standards Preparation, Traceability and Verification	4.6
SANA-QA-0018	Nonconformance & Corrective Action	4.10.5
SANA-QA-0016	Employee Orientation and Training	5.1.2
SANA-QA-0010	Technical and Compliance Assessment of Analytical Data	5.3.6
S-Q-003	Method Detection Limit Studies	5.3.5
S-T-002	Reporting Limits	5.3.5
SANA-IT-0001	Instrument Data Transfer and Back-up.	5.3.7
S-T-001	Quality Testing of Solvents	5.5.3
SANA-SC-0001	Sample Receiving Log-in & COC	5.7.2
SANA-SC-0015	Matrices, Phases, Compositing and Subsampling	5.7.3
S-Q-004	Acceptable Manual Integration Practices	5.8.4

STL Los Angeles
FACILITY SOP ATTACHMENT

SOP NUMBER: COI-MS-0008 rev 4		CHANGE FORM ID: CF1
SOP TITLE: Determination of Low Level VOCs by GC/MS SIM Mode (EPA Method TO-15)		
REASON FOR ADDITION (Use additional sheets if necessary): To add the lowest nominal standard in section 10.2.3		
ADDITION (Use additional sheets if necessary): Section 10.2.3. (Add 0.0025ppbv standard in the nominal concentrations of the standards) The nominal concentrations of the standards are typically 0.0025, 0.0075, 0.045, 0.25, 1.25, 5.0 and 9.0ppbv.		
Prepared By: Trupti Mistry/Maria Friedman		
*APPROVED BY:		
 Technical Review Signature		<u>4-26-06</u> Date
 Quality Assurance Manager		<u>4-26-2006</u> Date
 Environmental Health and Safety Coordinator		<u>4-26-2006</u> Date
 Laboratory Manager		<u>4-26-2006</u> Date

*Should be the same signature authorities of SOP being revised.

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Revision Date: 4/5/2006
Effective Date: 4/11/2006
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STANDARD OPERATING PROCEDURE

**TITLE: DETERMINATION of LOW-LEVEL VOLATILE ORGANICS (VOCs) in
AMBIENT AIR by GC/MS - SIM MODE (EPA METHOD TO-15)**

(SUPERSEDES REV. 3)

Prepared by:	<u>David Kammerer</u>	
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	Linda Scharpenberg, Environmental Health & Safety Coordinator	Date
Approved by:	<u>Elizabeth Winger</u>	<u>4/11/2006</u>
	Elizabeth Winger, Laboratory Director	Date

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SOP No.: COI-MS-0008
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1. SCOPE AND APPLICATION

- 1.1. This standard operating procedure (SOP) is applicable to the gas chromatography/mass spectrometry (GC/MS) determination of low-level volatile organic compounds in ambient air samples collected in passivated canisters. The analytical procedures that follow are based on EPA Method TO-15 performed in the single ion monitoring (SIM) mode.
- 1.2. Target analytes and reporting limits (RLs) are listed in Table 1.
- 1.3. Applicable matrices - air, vapor

2. SUMMARY OF METHOD

- 2.1. A pressurized air sample and internal standards are metered through a mass flow controller and concentrated onto a cryogenically cooled glass bead trap. The trap is heated and the contents are transferred to a Tenax trap to remove water. The Tenax trap is heated and the analytes are transferred to a cryofocusing module. The cryofocuser is heated to transfer the analytes to the gas chromatographic column for separation and detection by a mass spectrometer operated in the SIM mode.

3. DEFINITIONS

- 3.1. Batch - An analytical batch is defined as a set of up to 20 client samples of the same matrix processed using the same procedures within the same time period. A batch must contain a laboratory control sample (LCS), LCS duplicate (LCSD), and a method blank (MB). Refer to the STL Los Angeles Laboratory Quality Manual (STL LA LQM) for further details on the definition of a batch.
- 3.2. Method Blank - An MB consisting of all reagents added to the samples must be analyzed with each batch of samples. The MB is used to identify any background interference or contamination of the analytical system that may lead to the reporting of elevated concentration levels or false positive data.
- 3.3. Laboratory Control Samples - LCSs are laboratory-generated samples used to monitor the laboratory's day-to-day performance. The LCS/LCSD is spiked with the target compounds in Table 1, from which a sublist may be reported, as defined by NELAC requirements (see sections 9.5.1 and 9.5.2). The LCS/LCSD is used to monitor the accuracy of the analytical process, independent of matrix effects. Ongoing monitoring of the LCS/LCSD results provides evidence that the

laboratory is performing the method within accepted quality control (QC) guidelines for accuracy and precision. The LCS/LCSD is prepared from a source independent of the calibration standards. Other analytes may be required to meet project specific data quality objectives.

- 3.4. Surrogates - Surrogates are organic compounds which are similar to the target analytes in chemical composition and behavior in the analytical process, but which are not normally found in environmental samples. Although not required by the method, each sample, MB, LCS, and LCSD is spiked with surrogate standards. Surrogate spike recoveries may be evaluated against project specific requirements by determining whether the concentration (measured as percent recovery) falls within the required limits. Surrogate compounds are listed in Table 1.
- 3.5. Reporting Units - Routinely, calibration and sample results are calculated in part-per-billion volume/volume [ppb (v/v) or ppbv] units. Client-specific requirements may require conversion to mass/volume units.

4. INTERFERENCES

- 4.1. Contamination may occur in the sampling system if canisters are not properly cleaned prior to use. Canisters should not be used for the collection of samples until a batch blank analysis indicates that no target compounds are present above the RL, or a level previously agreed upon between STL and the client. Further information regarding the cleaning and certification of canisters may be found in the SOP COI-QA-0005. All other sampling equipment including pumps, flow controllers, and filters must be thoroughly cleaned to ensure that the filling apparatus will not contaminate samples.
 - 4.1.1. Canisters may also be individually certified clean as required by and at an additional cost to the client.
 - 4.1.2. Canisters will be certified clean down to the method detection limits (MDLs) of the target analytes of interest if sample results need to be evaluated down to those limits. However, the laboratory must be provided advanced notification of the requirement. Canister order must be placed with at least seven-day advanced notice or certification requirement may not be guaranteed.
- 4.2. Carryover may occur when samples with high levels of contaminants are analyzed. The sample immediately following a high-level sample should be re-analyzed if carryover is suspected.

5. SAFETY

5.1. Employees must abide by the policies and procedures in the Corporate Safety Manual (CSM), Lab Specific Addendum to the CSM, and this document.

5.2. Specific Safety Concerns and Requirements

- 5.2.1. Gas pressurized equipment is used in this procedure. Be sure all valves and gauges are operating properly and that none of the equipment is over-pressurized.
- 5.2.2. Sampling canisters should never be pressurized over 40 psig.
- 5.2.3. Due to high voltage risk, power to the GC and/or MS must be turned off or disconnected before work can be done on the instrument
- 5.2.4. The effluents from the sample splitters for the GC and the roughing pumps for the MS must be vented to a fume hood or at a minimum, must pass through a charcoal filter.
- 5.2.5. Both the GC and the MS contain elevated temperature zones. These zones must be cooled prior to an analyst or technician working on the unit
- 5.2.6. The MS is under deep vacuum and must be brought to atmospheric pressure before working on the source.
- 5.2.7. All compressed gas cylinders must be securely retained. All safety issues involving compressed gas cylinders should be followed.

5.3. Primary Materials Used

- 5.3.1. The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the materials safety data sheets (MSDS) for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	OSHA Exposure Limit (2)	Signs and symptoms of exposure/Unusual Hazards
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm- STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degrades the skin. May be absorbed through skin.
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Vapors may cause irritation to the skin and eyes. Overexposure may cause lightheadedness, nausea, headache, and blurred vision.
Benzene	Flammable Poison Carcinogenic	1 ppm TWA	Toxic by ingestion, inhalation and absorption. Causes headache, nausea, dizziness, weakness and breathing difficulties. This material is irritating on contact with the skin and eyes and may cause permanent eye damage.
Chloroform	Carcinogen Irritant	50 ppm Ceiling	Acts as a relatively potent anesthetic. Irritates respiratory tract and causes central nervous system effects, including headache, drowsiness, and dizziness. Causes skin irritation resulting in redness and pain and may be absorbed. Removes natural oils. Vapors cause pain and irritation to eyes. Splashes may cause severe irritation and possible eye damage.
Carbon Tetrachloride	Carcinogenic Poison	10ppm – TWA 200ppm STEL	Toxic by ingestion, inhalation and absorption. Causes headache, nausea, dizziness and narcosis. Contact with skin or eyes may cause irritation. Consumption of alcohol may increase toxic effects.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6. EQUIPMENT AND SUPPLIES

- 6.1. Gas chromatograph - capable of sub-ambient temperature programming and electronic pressure control

- 6.2. Mass-selective detector - equipped with computer and appropriate software (Hewlett Packard 5973)
- 6.3. Sample concentrator - equipped with a cryogenic trap and appropriate systems for the control of moisture (Entech 7100 or equivalent)
- 6.4. Electronic mass flow controller - device used to accurately meter gas flow in sample concentrators
- 6.5. Chromatographic grade stainless steel or nickel tubing and stainless steel plumbing fittings
- 6.6. Chromatographic column - Rtx-Volatiles, 0.32 mm ID, 1.5 μ m df, 60 m length, methyl polysilicate liquid phase (Restek Corporation or equivalent)
- 6.7. Stainless steel vacuum/pressure gauge capable of measuring from 30 inches of mercury (Hg) to 40 psig (Span Instruments or equivalent)
- 6.8. High precision vacuum gauge (for making daily standards) - Cole-Parmer Pressure Transmitter (Model No. P-07356-12) with Cole-Parmer Process Meter (Model No. 94785-00) or equivalent
- 6.9. Pressure regulators for carrier gas and standards – 2-stage, stainless steel diaphragm (single-stage acceptable for standards)
- 6.10. Passivated canisters (SUMMA, SILCO) - 1.0-li, 1.8-li, 6-li, 15-li (S.I.S., Restek, or equivalent)
- 6.11. 7-micron filters (Nupro or equivalent)
- 6.12. Variable Flow Regulator (VFR) - used during composite air sampling with passivated canisters
- 6.13. Diaphragm-type vacuum pump to draw sample through mass flow controller

7. REAGENTS AND STANDARDS

7.1. Reagents

- 7.1.1. UHP N₂ - used for MBs and preparing dilutions of samples and standards. All MBs are humidified with 50 μ l of distilled water
- 7.1.2. UHP Helium used as the GC carrier gas

7.1.3. Pressurized air source for EnTech 7100 heater gas

7.2. Standards

7.2.1. Gas calibration stock standards containing the target compounds are purchased from commercial sources or prepared from neat in passivated canisters. Suppliers must provide certification of the concentration.

7.2.2. Internal/Surrogate stock standard mix at 250 ppbv. Refer to Tables 5 and 6.

7.2.3. Expiration dates for standards and reagents are based on vendor specification. If no vendor expiration date is assigned, the laboratory assigns an expiration date of two years from the date of receipt. Refer to SOP SANA-QA-007 for further information on standards and expiration dates. Expiration dates must be documented on the gas cylinders.

7.3. Standard Preparation

7.3.1. Static dilutions of the stock standard gas mixtures is made in 6- or 15-li passivated canisters to create working standards. A high precision vacuum gauge is flushed with UHP N₂ and attached to the top valve of a clean, evacuated canister, and the absolute pressure is recorded.

7.3.2. Depending on the concentration of each stock standard gas mixture, a particular pressure of each is added to the canister to achieve the desired concentration in the working standard.

7.3.3. Care should be taken to flush each regulator, transfer line, and syringe with standard prior to transfer to the canister. After all the stock standard mixes are added, the standard canister is pressurized with UHP N₂ to achieve the appropriate concentration.

7.3.4. Currently, the daily standard has a nominal concentration of 1.25 ppbv and is created by adding 2 psi of the 25 ppbv low-level scan standard mix and adding UHP N₂ to the canister to achieve a final pressure of 40 psia.

7.3.5. Detailed standard preparation data may be found in logbooks NSL (Preparation of Gas Standards from Neat Liquids) and MSL (Preparation of Gas Standards from Gas Mixtures).

8. SAMPLE COLLECTION, PRESERVATION, AND STORAGE

- 8.1. Samples should be collected in certified clean (see section 4.1) passivated canisters. A 7-micron filter should be placed on the inlet of the canister to protect the valve from particulates. Canisters should never be pressurized over 40 psig.
- 8.2. The absolute pressure of the canister should be recorded before and after sample collection. See section 11.2 for sample preparation.
- 8.3. Samples should be protected from extreme temperatures.
- 8.4. Canisters samples should be analyzed within 30 days from collection.

9. QUALITY CONTROL

9.1. Initial Demonstration of Capability

- 9.1.1. Method Detection Limit (MDL) Study - STL LA will generate a valid MDL for each analyte of interest. The MDL must be below the RL for each analyte. The procedure for the determination of the MDL is specified in 40 CFR Part 136, Appendix B. MDL studies must be performed on an annual basis.

- 9.1.1.1. For non-standard analytes, an MDL study can be performed and calibration curve generated prior to sample analysis, unless lesser requirements are acceptable to the client. The minimum initial demonstration of capability (DOC) required is the analysis of a single-point calibration.

- 9.1.2. Demonstration of Capability - In addition to the MDL study, the laboratory must complete the analysis of four LCSs with acceptable accuracy and precision for each analyte. The DOC study will be updated annually to ensure an analyst's continued proficiency in the method.

- 9.2. Control Limits - When available, in-house historical control limits must be used for surrogates and LCSs. These limits must be reviewed and updated annually.

- 9.3. Surrogates - Surrogates are not a method requirement. The laboratory routinely adds surrogates to all QC and samples and will report these results if defined in a QAPP/SOW or at client's request.

- 9.3.1. Surrogate recoveries in client samples, blanks, and QC samples may be assessed to ensure that recoveries are within established limits. If any

surrogate is outside established limits and if surrogates are a project-specific requirement, the following corrective actions must be performed:

- 9.3.1.1. Check all calculations for error.
- 9.3.1.2. Ensure that instrument performance is acceptable.
- 9.3.1.3. Recalculate data and/or re-analyze if either of the above checks reveal a problem.
- 9.3.1.4. Re-analyze the sample or flag the data as "Estimated Concentration" if neither of the above resolves the problem.
- 9.3.2. It is only necessary to re-analyze a sample once to demonstrate that poor surrogate recovery is due to matrix effect, unless the analyst has reason to believe that the repeated out of control results are due to problems other than matrix effect.
- 9.4. Method Blank - For each batch of samples, an acceptable MB must be analyzed. The MB is analyzed after the calibration standards and LCS prior to sample analysis. Six-liter blank canisters are humidified with 50 μ L of water, pressurized to 40 psig with UHP N₂, and carried through the entire analytical sequence.
 - 9.4.1. The MB must not contain any analyte of interest at or above the RL. An MB that does not meet this criterion must be re-analyzed unless no reportable concentrations of target analytes are present in the associated samples.
 - 9.4.2. If surrogates are a project-specific requirement, then the MB must have acceptable surrogate recoveries. If surrogate recoveries are unacceptable, the data must be evaluated to determine if the MB has served the purpose of demonstrating that the analysis is free of contamination. If surrogate recoveries are low and there are reportable analytes in the associated samples, re-analysis of the MB and affected samples will normally be required.
- 9.5. Laboratory Control Samples - For each batch of samples, an LCS/LCSD pair must be analyzed. The LCS/LCSD is analyzed after the calibration standard and before the MB and samples. The LCS/LCSD is spiked with the target compounds in Table 1, from which a sublist may be reported, as defined by NELAC requirements (see below). Client-specific requirements may require additional compounds or even the full list of analytes.

- 9.5.1. NELAC Requirements on LCS composition – The following criteria shall be used for determining the minimum number of analytes to be spiked. However, the laboratory shall ensure that all targeted components are included in the spike mixture over a two-year period (NELAC Appendix D, D.1.1.2.1c, June 5, 2003, page 250 of 324):
 - 9.5.1.1. For projects that include 1 – 10 targets, spike all components.
 - 9.5.1.2. For projects that include 11 - 20 targets, spike at least 10 or 80%, whichever is greater.
 - 9.5.1.3. For projects with more than 20 targets, spike at least 16 components.
- 9.5.2. NELAC Requirements on LCS acceptance – The number of allowable exceedences is based on the number of analytes in the LCS. If more analytes exceed the LCS control limits than is allowed, the LCS fails and corrective action is necessary. Also, if the same analyte exceeds the LCS control limits repeatedly, it is an indication of a systematic problem; corrective action must, likewise, be performed (NELAC Appendix D, D.1.1.2.1e, June 5, 2003, page 251 of 324):
 - 9.5.2.1. 51 – 70 analytes in LCS, 3 analytes allowed to exceed control limits
 - 9.5.2.2. 31 – 50 analytes in LCS, 2 analytes allowed to exceed control limits
 - 9.5.2.3. 11 – 30 analytes in LCS, 1 analyte allowed to exceed control limits
 - 9.5.2.4. <11 analytes in LCS, no analyte allowed to exceed control limits
- 9.5.3. If the acceptance criteria specified in section 9.5.2 are not met, the analysis is out of control and corrective action must be performed. Corrective action will normally be re-analysis of the batch.
 - 9.5.3.1. Evaluate the analytical run for errors and anomalies. Re-analyze the LCS.
 - 9.5.3.2. Check the standard for appropriate pressure. Low pressure will often cause failure. Re-pressurize or prepare a new standard and re-analyze the LCS/LCSD.

- 9.5.3.3. Evaluate the instrument status and perform maintenance. Re-analyze the continuing calibration verification (CCV) standard and LCS/LCSD or recalibrate.
 - 9.5.3.4. If the batch is not re-analyzed, the reasons for accepting the batch (e.g., insufficient sample volume for re-analysis) must be clearly stated in the report narrative.
 - 9.5.3.5. If the analytes in the LCS exceed the upper control limit and no analytes are detected in any of the samples; they may be reported without qualification. Positive bias is not expected to impact ND results.
- 9.6. Internal Standard (IS) - The IS (bromochloromethane) area is monitored for each shift by comparing the IS area in each sample with the IS area in the associated continuing calibration verification (CCV) standard.
- 9.6.1. Sample IS area is considered acceptable if it falls between $\pm 40\%$ of the CCV IS area. Any sample exceeding this criterion must be re-analyzed. If the IS area fails upon re-analysis, the failure is documented in a non-conformance memo (NCM) and discussed in the report narrative.
- 9.7. Sample Duplicate Analysis
- 9.7.1. A sample duplicate is analyzed and reported with every 20 samples, if requested.
 - 9.7.2. The acceptance criterion for the duplicate analysis is a relative percent difference (RPD) ≤ 25 for target compounds that are $>5X$ the RL. No criterion is established for duplicate results $<5X$ the RL. The calculations are provided in section 12.2.
- 9.8. Nitrogen Check
- 9.8.1. Before a new N_2 cylinder is used for the pressurization of samples or standards, it must be analyzed as a blank and pass all the criteria in section 9.4.
- 9.9. Annual Gauge Calibration
- 9.9.1. The master gauge, used to calibrate the gauges in the laboratory for measuring cylinder and canister pressure or vacuum, must be certified annually. The certification process is performed by an outside calibrating agency.

9.10. Process Flow Meter Calibration

9.10.1. The process flow meter, used in the laboratory to set the flow regulators at the client-requested flow rates for time-weighted sampling events, must be certified quarterly. The certification process is performed by an outside calibrating agency.

9.11. Standards and other QC samples (e.g., BFB, LCS/LCSD, CCV, etc.) may not be analyzed more than twice without documented corrective action. If the initial run fails acceptance criteria, re-inject standard or QC sample. If second run passes, analysis may proceed. Otherwise, conduct instrument maintenance or perform corrective action. Completely document failure, corrective action performed, and return to control in the instrument maintenance logbook.

10. CALIBRATION AND STANDARDIZATION

10.1. Prior to the analysis of samples and blanks, each GC/MS system must be tuned and calibrated. Tuning is checked to establish that the system meets the standard mass spectral abundance criteria. See Table 4 for the PFTBA standard spectrum tuning acceptance criteria.

10.2. Initial Calibration and Verification

10.2.1. An initial calibration (ICAL) curve consisting of a minimum of five points is analyzed to determine the linear working range of the analytical system for each compound. An average response factor (RF), or sometimes called the relative response factor (RRF), and the percent relative standard deviation (%RSD) are calculated for each target analyte using the calculation in section 12.2.

10.2.1.1. The ICAL is considered acceptable if at least 90% of the target analytes have a %RSD ≤ 30 and the average of the %RSDs for all compounds, including the surrogates, is ≤ 30 .

10.2.1.2. Client- or project-specific requirements may dictate that the laboratory adhere to the following TO-15 criteria: The %RSD for the RFs for all target analytes in the ICAL must be ≤ 30 , with up to two target analytes that may have a %RSD of ≤ 40 .

10.2.2. Subsequently, linear or quadratic curve fits may be used with at least six calibration points. The correlation coefficient r (coefficient of determination for non-linear curves, r^2) must be ≥ 0.995 ; r^2 must be ≥ 0.990 . Please refer to the following equations:

10.2.2.1. Calculation of Linear Fit

$$C_{ex} = A + B \frac{(R_x C_{is})}{R_{is}}$$

Where: C_{ex} = Concentration in extract, $\mu\text{g/mL}$
 R_x = Response for analyte
 R_{is} = Response for internal standard
 C_{is} = Concentration of internal standard
 A = Intercept
 B = Slope

10.2.2.2. Calculation of Quadratic fit

$$C_{ex} = A + B \left(\frac{R_x C_{is}}{R_{is}} \right) + C \left(\frac{R_x C_{is}}{R_{is}} \right)^2$$

Where: C_{ex} = Concentration in extract, $\mu\text{g/mL}$
 R_x = Response for analyte
 R_{is} = Response for internal standard
 C_{is} = Concentration of internal standard
 A = Intercept
 B = Slope
 C = Curvature

10.2.2.3. In a linear or quadratic calibration fit, the points at the lower end of the calibration curve have less weight in determining the curve generated than points at the high concentration end of the curve. For this reason, it is preferable to increase the weighting of the lower concentration points. $1/\text{Concentration}^2$ weighting (often called $1/X^2$ weighting) will improve accuracy at the low end of the curve and should be used if the data system has this capability. The analyst should consider instrument maintenance to improve the linearity of response.

10.2.3. The nominal concentrations of the standards are typically 0.0075, 0.045, 0.25, 1.25, 5.0, and 9.0 ppbv but these may vary depending on the certified mix used to prepare the standards or the volume trapped. The lowest standard must be at or below the RL. The standards are run by varying the trapped volume of three working standards from the "default" volume of 500 mL. For example, the 0.0075 and 0.045 ppbv

standards are analyzed by trapping 50 and 300 mL, respectively, of the 0.075 ppbv working standard.

- 10.2.4. The IS response at each calibration level must be ± 40 percent difference (%D) of the IS response in the mid-level of the ICAL.

10.2.4.1. The retention time (RT) shift of the IS at each calibration level must be within 0.50 minutes of the RT of the IS in the mid-level of the ICAL.

- 10.2.5. Each analyte at each level must be within 0.06 relative retention time (RRT) units of the mean RRT.

- 10.2.6. The analyst may elect to drop points from the calibration curve to improve subsequent quantitation. The following rules apply. However, for further guidance, see the current revision of STL Policy P-T-001, Selection of Calibration Points.

10.2.6.1. Points below the RL may be dropped as long as there is a point remaining at or below the RL.

10.2.6.2. High points may be dropped but at the expense of decreasing the linear range.

10.2.6.3. Calibration points in between the low and high ends may NOT be dropped.

- 10.2.7. Each new five-point ICAL must be verified using a second-source standard (also called an initial calibration verification, ICV, standard). Since the regulatory agencies have not provided guidance on second-source verification, the following acceptance criteria are used: ± 30 %D for the standard target analytes identified in Table 1 and up to ± 55 %D for non-standard (or add-on compounds not in Table 1) compounds which may exhibit uncharacteristic chemical behavior that warrants wider acceptance criterion.

10.2.7.1. The limits in section 10.2.7 are provided as guidance. If these criteria are not met, the following corrective actions must be performed:

10.2.7.1.1. Rerun the second source check standard.

10.2.7.1.2. Re-prepare or acquire a new standard.

10.2.7.1.3. Evaluate instrument conditions.

10.2.7.1.4. Regenerate a new ICAL.

10.2.7.2. Due to the limited availability of second-source suppliers for the air standard mixes and some neat compounds, the following options may be considered as second-source:

10.2.7.2.1. Use of a certified different lot from the same vendor.

10.2.7.2.2. Preparation of an independent standard using the same source as the first standard but by another analyst. This procedure is particularly applied when the air standard was prepared from a neat liquid.

10.2.8. Analyte quantitation must be performed off the initial calibration and not from daily continuing calibration standard analysis. Test results must be qualified in reports when analyte quantitation is based on the CCV at the client's request.

10.2.9. Unless the QC batch (or every 24 hours of operation) follows an ICAL and an ICV, a CCV standard is analyzed to verify the ICAL average RF. The %D of the CCV RF from the ICAL average RF is calculated for each compound. The average of the %D for 90% of all target compounds, including the surrogates, must be ≤ 30 . If the criterion is not met, the CCV must be re-analyzed or a new ICAL generated prior to sample analysis.

10.2.9.1. CCVs may be analyzed more frequently depending on documented client requirements, such as every ten samples or every 12 hours.

10.2.9.2. The concentration of the ICV or CCV must be varied.

11. PROCEDURE

11.1. One time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM and approved by a Technical Specialist and the QA Manager. If contractually required, the client shall be notified. The NCM shall be filed in the project file.

11.2. Sample Preparation

- 11.2.1. The initial pressure of the sample canister is checked and recorded by attaching a vacuum/pressure gauge to the canister. The gauge should be rinsed before use with zero grade N₂ by physically holding against the air outlet and flushing for 10 seconds.
- 11.2.2. If the pressure is less than 6 psig, pressurize the canister with zero grade N₂ to 15 psia, or to approximately 2 times the initial pressure, whichever is higher. Record the final pressure. Record all readings in the sample pressurization logbook and on the canister field data sheets.
- 11.2.3. If the canister pressure is increased, a dilution factor (DF) is calculated and applied to results:

$$DF = \frac{Y_a}{X_a}$$

Where: X_a = absolute canister pressure before dilution (initial pressure)
Y_a = absolute canister pressure after dilution (final pressure)

- 11.2.3.1. The pressure dilution factor (pDF) must be compensated for by trapping more sample. For example, a sample received at 12.0 psia and pressurized to 24.6 psia has a pDF of 2.05. If the default volume is 500 mL, then 1030 mL should be trapped (the volume is rounded **up** to three significant figures).
- 11.2.4. Canisters received where no sample was collected (i.e., trip blanks) are pressurized and are considered to have a pDF = 1.0.
- 11.2.5. Samples may be screened, to check for contamination before analysis or if suspected to contain significant contamination, using GC/FID analysis or other screening method to determine a proper dilution. The following screening procedure is followed:
 - 11.2.5.1. Remove the sample from Sample Control by completing the Internal Chain of Custody logbook.
 - 11.2.5.2. Attach the sample to an active sample line on the GC screening instrument.

11.2.5.3. Start the screen sequence in the instrument data system.

11.2.5.4. Push START on the instrument.

11.2.5.5. Open sample container valve.

11.2.5.6. Collect data report and determine the dilution required for the analysis.

11.2.6. A sample that requires only a small dilution can be analyzed by trapping a volume less than the standard volume. The minimum volume that can be trapped is 20 mL. Larger dilutions will require an additional pressure dilution. If non-standard RLs are required, the standard sample volume can be adjusted. The maximum volume that may be trapped is 1500 mL.

11.3. Water Addition

11.3.1. The analyst should be aware that humidity plays an important role in the recovery of certain target compounds, particularly polar compounds, and should be prepared to add humidity to canisters where appropriate. The addition of water helps to stabilize the behavior of these compounds, which might otherwise interact with the interior surface of the canister or with the stainless-steel lines of the sample manifold.

11.3.2. Since it is not practical to know the relative humidity of all canisters received at the laboratory, the analyst should assume that canisters are received at approximately 80 percent relative humidity. When preparing canister dilutions, the analyst should attempt to preserve the relative humidity of canisters at a level that will minimize recovery loss due to low canister relative humidity.

11.3.3. Under normal laboratory conditions, a 6-L canister at ambient pressure will have a relative humidity of 100% if approximately 100 uL of water is in the canister.

11.3.3.1. The minimum relative humidity at which canisters containing polar analytes can be analyzed before polar target recovery is negatively affected is approximately 20 – 30%.

11.3.3.2. The minimum relative humidity at which canisters containing nonpolar analytes can be analyzed before nonpolar target recovery is negatively affected is approximately 10%.

11.4. Major Maintenance

- 11.4.1. A new initial calibration is necessary following major maintenance such as changing the column, cleaning or repairing the source, replacing filaments, changing electronics, replacing the multiplier or changing moisture or Tenax traps.

11.5. Minor Maintenance

- 11.5.1. Minor maintenance includes cleaning the injector port, replacing filters, changing the pump oil, autotuning, switching filaments (instrument contains two filaments under vacuum), replacing the syringe or injector tower, change/refill the calibration vial, changing seals and o-rings, ballasting pump, replacing fuses, replacing roughing pumps or transfer lines.

11.6. Initial/Daily GC/MS Tuning

- 11.6.1. At the beginning of each 24-hour shift prior to any analytical run, the GC/MS system must be verified that acceptable tune performance criteria are achieved. If any of the criteria listed in Table 4 are not met, the system is considered out of tune and any subsequent sample/standard analysis should be considered unacceptable.

11.7. Sample Analysis

- 11.7.1. All analysis conditions for samples must be the same as that of the CCV's, including flow rates, desorb time and temperature, column temperatures, multiplier setting, etc.
- 11.7.2. Each canister is attached to the autosampler (A/S) and recorded in the instrument run log.
- 11.7.3. A sequence is created in the GC/MS software to prepare the instrument for data acquisition. The sequence information controls the GC/MS method, data file creation, sample parameters, and report output.
- 11.7.4. A second sequence must be created in the A/S control software to control the sampling process, such as, line position, sample volume, trap temperatures, flow rates, and times.
- 11.7.5. The valves are opened on all canisters and the A/S and GC/MS sequences are started.

- 11.7.6. For routine analysis, the A/S will follow the sequence of events below (parameters may be modified based on instrument performance):
 - 11.7.6.1. Glass bead trap (Module 1) cooled to -150°C .
 - 11.7.6.2. Trap internal standard.
 - 11.7.6.3. Trap sample.
 - 11.7.6.4. The tenax trap (Module 2) is cooled to -10°C and the glass bead trap is heated to 20°C . The sample is transferred to Module 2 by passing helium through Module 1. This step is designed to remove water from the sample.
 - 11.7.6.5. When GC is ready, the cryofocuser (Module 3) is cooled to -150°C . Module 2 is heated to 180°C . The sample is transferred to Module 3.
 - 11.7.6.6. Module 3 is heated and the GC/MS column flow is routed through Module 3 to inject the sample and begin the run.
 - 11.7.6.7. The system is pre-flushed with the next sample and the system is baked to eliminate carryover.
- 11.7.7. Upon completion of the analytical sequence, the concentrator generates a QA/QC report, which records data from the sampling event (i.e., actual volume trapped, temperature at the time of trapping, sample pressure, etc.).

12. DATA INTERPRETATION

12.1. Qualitative Analyses

- 12.1.1. Two criteria must be satisfied to verify positive identification.
 - 12.1.1.1. Elution of sample component at the same GC relative or absolute retention time as those of the standard component:
 - 12.1.1.1.1. The sample RRT must compare within ± 0.06 RRT units of the RRT of the standard component.
 - 12.1.1.1.2. As an option, RT must compare within 0.33 minutes of the standard component absolute RT.

For reference, the RT standard must be run within the same 24-hour shift as the sample.

12.1.1.2. Correspondence of the sample component and the standard component mass spectra.

12.1.1.2.1. All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) must be present in the sample spectrum.

12.1.1.2.2. The relative intensities of ions specified in (section 12.1.1.2.1) must agree within $\pm 30\%$ between the standard reference and sample spectra. For example, for an ion with an abundance of 50% in the reference spectra, the corresponding sample abundance must be between 20% and 80%.

12.1.1.3. If a compound cannot be verified by all of the criteria in the above paragraphs but in the technical judgment of the analyst the identification is correct, then the compound may be reported. A "JA" flag is used to identify the difference in the spectra.

12.1.2. Tentatively Identified Compounds (TICs) – TICs are unavailable in the SIM mode.

12.1.3. All manual integration or re-integration of chromatograms must be documented in accordance with STL Policy S-Q-004. Documentation includes, at a minimum, before and after copies of the chromatograms with a reference to the reason for re-integration, date, and initials. All manual integrations must undergo a documented second level review.

12.2. Calculations

12.2.1. The Target data system automatically quantitates the sample results based on a "standard" sample size of 500 mL. The default result units are in ppbv.

12.2.2. If a sample size other than 500 mL was used and/or a canister sample was pressurized, the result must be adjusted as shown below:

$$\text{Final result ppbv} = \text{raw result ppbv} \times \frac{500\text{mL}}{\text{sample volume injected}} \times \frac{\text{final psia}}{\text{initial psia}}$$

12.2.3. Calculation for Relative Response Factor (RRF):

$$\text{RRF} = \frac{\text{Area cpd in Std.}}{\text{Area I.S.}} \times \frac{\text{Conc. I.S.}}{\text{Conc. cpd in Std.}}$$

The area of the primary quantitation ion is used in the calculation.
I.S. = Internal Standard

12.2.4. Calculation for Percent Relative Standard Deviation (%RSD):

$$\% \text{RSD} = \frac{\text{Std. Dev. of RRFs}}{\text{Mean of RRFs}} \times 100$$

12.2.5. Calculation for Percent Difference (%D):

$$\% D = \frac{\text{Average RRF from initial curve RRF cpd.}}{\text{Average RRF from initial curve}} \times 100$$

12.2.6. Calculation for Determining Concentration of Compounds:

$$\text{Conc. Cpd (ppbv)} = \frac{\text{Area cpd in sample}}{\text{Area I.S. in sample}} \times \frac{\text{Conc. I.S.}}{\text{RRFICAL.}} \times \text{Dil. Factor}$$

The area of the primary quantitation ion is used in the calculation.
I.S. = Internal Standard

12.2.7. Calculation for Percent Recovery (%Rec):

$$\% \text{ Rec} = \frac{\text{Amount cpd. recovered}}{\text{Amount cpd. spiked}} \times 100\%$$

12.2.8. Calculation for Relative Percent Difference (RPD):

$$RPD = \frac{Value A - Value B}{Average of Values} \times 100$$

13. REPORTING

- 13.1. Standard reporting units are ppbv (also ppb v/v). If results are to be reported in ng/L or ug/m³, use the following equation:

$$result\ ppbv \times \frac{Molecular\ weight\ of\ compound}{24.5} = results\ ng/L\ or\ ug/m^3$$

Note: 24.5 is the molar volume of ideal gas in liters at 25°C and 1 atm.

- 13.2. All reporting limits and MDLs must be derived on GC/MS systems at the STL laboratory and must be updated annually. See Table 1.
- 13.3. Estimates of uncertainty are based upon the LCS historical control limits.
- 13.4. "J" values (results below the RL but above the MDL) are only reported when requested by clients.
- 13.5. No conversion of the analytical results to standard conditions is made.

14. METHOD PERFORMANCE

- 14.1. Method performance is controlled through the measurement of accuracy and precision. Analysis of an LCS and LCSD are performed to measure both accuracy and precision. The control limits established for the LCS and LCSD are used to maintain method performance within a well-defined set of criteria.
- 14.2. Monitoring of background contamination by the analysis of method blanks, trip blanks, and system blanks is also critical to method performance.

15. POLLUTION PREVENTION AND WASTE MANAGEMENT

- 15.1. All waste will be disposed of in accordance with federal, state, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by and this procedure. This method is set up in accordance with section 13 of the CSM for "Waste Management and Pollution Prevention."
- 15.2. Waste Streams Produced

- 15.2.1. Lab Trash – Tedlar Bags, gloves, etc. are placed in 5-gal buckets in the laboratory and then transferred to a 55-gal steel drum in the 90-day area.
- 15.2.2. Expired standards in cylinders are returned to the manufacturer.

16. REFERENCES

- 16.1. "EPA Compendium Method TO-15. The Determination of Volatile Organic Compounds (VOCs) in Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)." January 1999.
- 16.2. STL LA LQM, current revision.
- 16.3. National Environmental Laboratory Accreditation Conference (NELAC). EPA/600/R-04/003. June 2003.

17. MISCELLANEOUS (TABLES, APPENDICES, ETC.)

17.1. Deviations from Method

- 17.1.1. Nitrogen is used for dilution/pressurization purposes.
- 17.1.2. Method TO-15 describes a shelf life of thirty days for primary working standards. STL LA maintains these standards for longer periods as determined by the manufacturer's recommendation and the results of stability monitoring.
- 17.1.3. Method TO-15 describes tune criteria for BFB. Many clients require standard spectrum tuning. STL LA uses the criteria listed in Table 4 to check tunes. The requirements in Table 4 are compliant with the Colorado Department of Public Health and Environment (CDPHE) specifications. These criteria are appropriate for SIM analysis because the quantitation relies on accurate identification of masses.
- 17.1.4. Method TO-15 indicates that in order for the ICAL to be acceptable, all compounds must have a %RSD <30 (with allowance for two that could be up to 40%). For routine analysis, STL LA accepts the ICAL if 90% of the target compounds have a %RSD ≤30 and if the average of the %RSD for all target compounds is <30%. This modification accounts for analytical issues that arise for poor performing analytes.
- 17.1.5. For the CCV criteria, Method TO-15 states that the %D for each target compound must compare to the ICAL at ±30%. For routine analysis, STL LA accepts the CCV if 90% of the target compounds have a %D

± 30 . This modification accounts for analytical issues that arise for poor performing analytes.

17.1.6. Method TO-15 sets accuracy and precision criteria of $\pm 30\%$ and $\leq 25\%$, respectively. STL LA uses project-specific QC criteria or control limits based on historical data that may be wider than the method limits.

17.1.7. Surrogates are not required by the method. This SOP adds surrogates to every sample to help monitor for matrix effects and method performance. However, surrogates are not reported unless requested.

17.2. Tables

Table 1. Target Compounds, Reporting Limits and QC Acceptance Limits

Compound	RF (ppt/L)	QC Limits (%R)	% RPD
Benzene ***	0.062	70 - 125	20
Bromodichloromethane ***	0.011	70 - 120	20
Carbon Tetrachloride	0.010	50 - 150	20
Chlorobenzene	0.020	70 - 130	20
Chloroform ***	0.014	75 - 120	20
Chloromethane	0.045	70 - 130	20
1,2-Dichlorobenzene	0.045	70 - 130	20
1,3-Dichlorobenzene	0.045	70 - 130	20
1,4-Dichlorobenzene	0.045	70 - 130	20
1,1-Dichloroethane ***	0.020	70 - 120	20
1,2-Dichloroethane ***	0.020	70 - 125	20
cis-1,2-Dichloroethene ***	0.014	65 - 120	20
trans-1,2-Dichloroethene ***	0.014	70 - 130	20
1,1-Dichloroethene ***	0.010	70 - 120	20
trans-1,3-Dichloropropene	0.020	70 - 130	20
cis -1,3-Dichloropropene	0.020	70 - 130	20
1,4-Dioxane	0.15	70 - 130	20
Ethylbenzene	0.020	70 - 130	20
4-ethyltoluene	0.020	70 - 130	20
Methylene chloride ***	0.12	65 - 120	20
Styrene	0.020	70 - 130	20

Compound	REL ppb(V/L)	GC-Units (%R)	% RPD
1,1,2,2-tetrachloroethane	0.020	70 - 130	20
Tetrachloroethene ***	0.10	70 - 125	20
Toluene	0.020	70 - 130	20
1,1,1-Trichloroethane ***	0.020	70 - 130	20
1,1,2-Trichloroethane ***	0.018	70 - 120	20
Trichloroethene ***	0.0075	70 - 120	20
Trichlorofluoromethane	0.045	70 - 130	20
1,2,4-trimethylbenzene	0.020	70 - 130	20
1,3,5-trimethylbenzene	0.045	70 - 130	20
Vinyl chloride ***	0.0075	70 - 125	20
m- & p-Xylene	0.040	70 - 130	20
o-Xylene	0.020	70 - 130	20
1,2-Dichloroethane-d4**	--	70 - 130	--
Toluene-d8**	--	70 - 130	

** Surrogate compound

*** Control analytes routinely reported for this method. The full analyte list, or a client specific analyte list may be reported at client request. Analytes on the routine control list may not be reported if not on a client specific target list.

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Table 2. GC Analytical Method

Method file: SIM14WS

METHOD FILE LIST

Method Parameters		GC Type: 6890	Run type: SIM,GC,E1	
		Column: Cap	Splitless: Yes	
Temperature:	Inj.P	Intfc	Source	
	120	280	230	
GC		LEVEL A	LEVEL B	POST RUN
Temp 1	35	35	150	0.0
Time 1	5.5	0.0	0.0	
Rate		11	30	
Temp 2		150	200	
Time		0.0	8.0	
Oven equilibration Time.	0.0 min			
Run time:	25.6 mins			
Scan Start time	4.20 mins			
Acquisition Mode: SIM				

Table 3. SIM Key Ions*

Compound	Primary Ion	
Bromochloromethane I.S.	130	
Vinyl Chloride	62	64
1,1-Dichloroethene	96	98
Methylene Chloride	49	84
trans-1,2-Dichloroethene	96	98
1,1-Dichloroethane	63	65
cis-1,2-Dichloroethene	96	98
Chloroform	83	85
1,1,1-Trichloroethane	97	99
1,4-Difluorobenzene Surr.	65	
Benzene	78	52
1,2-Dichloroethane	62	64
Trichloroethene	130	132
Bromodichloromethane	85	83
1,1,2-Trichloroethane	97	83
Tetrachloroethene	166	164

* Compounds may be added to the target list based upon lab calibration and QC data in the previous year.

Table 4. TO-15 SIM Tuning Criteria – PFTBA

Mass	Ion Abundance Criteria
69	Plus or minus 0.10 amu, Peak Width 0.40 – 0.60
219	Plus or minus 0.10 amu, Peak Width 0.40 – 0.60
502	Plus or minus 0.10 amu, Peak Width 0.40 – 0.60
70	0.75 to 1.25% of 69
220	3.75 to 6.25% of 219
503	7.50 to 12.5% of 502

Table 5. Internal Standards*

Bromochloromethane
1,4-Difluorobenzene
Chlorobenzene-d5

Table 6. Surrogates*

4-Bromofluorobenzene
1,2-Dichloroethane-d4
Toluene-d8

*Depending upon client/project target list requirements, individual IS or surrogates may be chosen for analysis instead of all six.

18. SOP REVISION HISTORY

- 18.1. This section has been added beginning with revision 4. Prior revisions are documented in the QA files.
- 18.2. Changes to revision 3 implemented in revision 4:
 - 18.2.1. All references to "SUMMA canister" in the previous SOP revision have been modified to either "passivated canister" or "canister". Method TO-15 references the analysis of volatile organics in air samples collected in specially prepared canisters, not particularly "SUMMA" canisters.
 - 18.2.2. Sections 3.3 and 9.5 were modified to include reference to the NELAC requirements regarding the number of target analytes that must be included in LCSs.
 - 18.2.3. Sections 4.1.1 and 4.1.2 were added to define additional canister certification requirements that may be requested from the laboratory.
 - 18.2.4. Sections 4.5, 4.6, and 4.7 were added to include other possible interferences to method performance.

- 18.2.5. Section 5 (Safety) was modified by the EH&S Coordinator in order to comply with the requirements of the CSM.
- 18.2.6. All references to "EnTech 7000" in the previous SOP revision have been modified to "EnTech 7100". The laboratory no longer uses EnTech 7000.
- 18.2.7. Section 7.2.3 was added to include information regarding expiration dates for standards and reagents.
- 18.2.8. Section 10.2 of the previous revision that discusses standard preparation was updated and enhanced. This section was also moved as section 7.3 (under Reagents and Standards) in this current revision.
- 18.2.9. The canister pressurization limit specified in section 8.1 was modified from 30 psig to 40 psig.
- 18.2.10. The NELAC requirements for LCS reporting were added as sections 9.5.1 and 9.5.2.
- 18.2.11. Enhanced corrective action measures, when the LCS fails, were also added as section 9.5.3.
- 18.2.12. Section 9.7 was added to address the acceptance criteria for sample duplicate analysis, if requested by client.
- 18.2.13. Section 9.8 was added to address the contamination check on the N₂ supply used to pressurize samples.
- 18.2.14. Section 9.9 was added to address the annual certification required for the master gauge that is used to calibrate the gauges used for samples and standards.
- 18.2.15. Section 9.10 was added to address the quarterly certification required for the process flow meter that is used to set-up the flow rates of the flow regulators used by clients for time-weighted sampling events.
- 18.2.16. Section 9.11 was added to identify the guidelines to be followed when standards or QC samples need to be re-analyzed multiple times.
- 18.2.17. Section 10.2.2 was added to address the use of linear or quadratic fits, when needed.
- 18.2.18. Section 10.2.4 was added to address the IS criteria used in the ICAL.

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- 18.2.19. Section 10.2.4.1 was added to address the RT shift criteria for the IS in the ICAL.
- 18.2.20. Section 10.2.5 was added to address the RRT criteria for each analyte at each level in the ICAL.
- 18.2.21. Section 10.2.6 was added to address the criteria to be used when it becomes necessary to drop points from the ICAL.
- 18.2.22. Section 10.2.7 was modified to address the new acceptance criteria for the ICV (second source) standard.
- 18.2.23. Section 10.2.7.2 was added to address the alternatives that may be followed when second source standard suppliers are limited.
- 18.2.24. Section 11.2.1 of the previous revision that discusses sample analysis using the same analytical conditions used for the CCV was moved as section 11.7.1 in this current revision.
- 18.2.25. The number of seconds required to flush the pressurization gas line prior to each sample has been defined in Section 11.2.1.
- 18.2.26. The dilution factor used in the analysis of trip blanks has been defined in section 11.2.4.
- 18.2.27. The sample screening procedure performed in the laboratory prior to definitive analysis has been defined in section 11.2.5.
- 18.2.28. The minimum volume of sample that can be trapped in the GC/MS system, as identified in section 11.2.6, was modified from 40 mL to 20 mL.
- 18.2.29. Section 11.3 was added to address the requirement for sample humidification, when deemed necessary.
- 18.2.30. The requirement for a new calibration curve, after major changes to the GC/MS system occurred, has been addressed in section 11.4.
- 18.2.31. Some examples of minor maintenance to the GC/MS system have been defined in section 11.5.
- 18.2.32. The proper documentation procedure to be followed by the laboratory when manual peak integration is performed was added in section 12.1.3.

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- 18.2.33. Section 15 was modified to address proper disposal of laboratory trash and return of expired standards to manufacturers.
- 18.2.34. Reference to the use of the NELAC document for QA guidance was added in section 16.
- 18.2.35. The SOP deviations from Method TO-15 were updated. This section, previously 16.3 in the SOP's previous revision, was also moved as section 17.1 (under Miscellaneous) in this current revision.
- 18.2.36. All other sections were only modified for clerical corrections.

ATTACHMENT D

Attachment D
Contact List

[illegible]

[illegible]

Effective Date of AOC 12-19-06

[illegible]

ATTACHMENT E

Attachment E
Canister Data Form

**FORM A-1
CANISTER DATA FORM**

I. GENERAL INFORMATION

Company Name: _____
Canister ID No.: _____

Company Contact: _____
Sampler ID No.: _____

Company Address: _____
Vacuum Controller ID No.: _____

Flow Controller ID No.: _____

Telephone No.: _____
Canister Leak Check Date: _____

Facsimile No.: _____
Shipping Date: _____

II. SAMPLING INFORMATION

Sampling Date: _____

Sampling Address: _____

Location of Canister is Place: _____

Use of Room Where Canister is Place: _____

Room Furnishings: _____

Materials Stored in Room: _____

Weather Conditions During Test: _____

TEMPERATURE:
BAROMETRIC PRESSURE

INTERIOR	AMBIENT	MAXIMUM	MINIMUM
----------	---------	---------	---------

START _____

STOP _____

Canister VACUUM on OPENING Valve: _____

DATE Canister Valve OPENED: _____ TIME Canister Valve OPENED: _____

DATE Canister Valve CLOSED: _____ TIME Canister Valve CLOSED: _____

Signature

Date

ATTACHMENT F

Attachment F

Property Information Form

FORM A-2
PROPERTY INFORMATION FORM

Date: _____ Time: _____ Inspector: _____

Pictures Allowed: ☐ Yes ☐ No

Sample No. _____

Address: _____

Contact Name: _____

BUILDING TYPE: One story: _____ Multi-story _____ Brick _____ Siding _____ Stucco _____

WEATHER SEALS: General Condition: Good _____ Fair _____ Poor _____

BASEMENT:	None	<input type="checkbox"/>	Finished	Unfinished	Depth below grade
	Partial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Full	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Crawl space	<input type="checkbox"/>	na	na	_____

Foundation construction: Poured concrete ☐ Cinder block ☐

Condition at floor/wall joint (if visible) _____

Floor drains, sump _____

Vents, fans, windows _____

Floor condition (type, cracks, drains) _____

Wall openings, utility pipe penetrations _____

Moisture Condition (dry, damp, wet) _____

FURNACE: Location: _____

Type: gas ☐ Forced air ☐

oil ☐ hot water ☐

electric ☐ other _____

Blower capacity (if applicable) _____

Does furnace have outside combustion air vent? _____

Winter temperature setting: day _____ night _____

AIR CONDITIONER: None _____ Central _____ (if yes, capacity?) _____ Room _____

(If yes, which rooms and capacities? _____)

RADON SYSTEM: Yes ____ No ____ If yes, floor scaled? _____

Floor drain/sump vent? _____

Other ventilation? _____

Pictures Taken:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

ATTACHMENT G

Attachment G
Occupant Questionnaire

FORM A-3
PROPERTY QUESTIONNAIRE

DaimlerChrysler, in cooperation with the U.S. Environmental Protection Agency, will collect indoor air samples from properties in an area near the Behr Dayton Thermal Systems Plant, Dayton, OH. These samples will be analyzed to detect volatile organic compounds (VOC) vapors inside buildings.

VOCs are found in outside air and in the air inside of buildings. VOCs can be found in solvents and other household items, such as pesticides, insecticides, adhesives, aerosols, paints, coatings, dry cleaning, carpet and drapery cleaning fluids, and household spot removers. Other common VOC sources include telephone and computer cables, plastic items, vinyl cove molding, PVC plumbing, linoleum, concrete blocks, latex paint, carpet padding, foam rubber, lubricants, and cosmetics.

Your answer to the following questions will help us determine if sources of VOCs exist at your property. Please answer each question to the best of your knowledge.

1. When was the last time dry-cleaned clothes were brought into the building?

☐ 0 to 5 days ago ☐ 6 to 10 days ago ☐ More than 10 days ago

2. When was your carpet installed?

☐ In the last six months ☐ More than six months ago

3. When was the last time your carpet was cleaned?

☐ In the last six months ☐ More than six months ago

4. Do you have any spot removers in the house?

☐ Yes ☐ No

5. Do your hobbies include model buildings, arts and crafts, model railroading metal cleaning, or others that require paints, thinners, solvents, or glue?

☐ Yes ☐ No

6. Do you perform automotive or other vehicle maintenance or repair at home?

☐ Yes ☐ No

7. Please review the following list and check items you know are in your home.

- ☐ Latex caulk
- ☐ Latex paint
- ☐ Vinyl cove molding
- ☐ Linoleum tile
- ☐ Large diameter telephone cable
- ☐ Small diameter telephone cable
- ☐ Black rubber molding
- ☐ Vinyl edge molding

☐ Polystyrene foam insulation

☐ Cement block

☐ Treated metal roofing

8. Do you have pesticides in your home?

☐ Yes

☐ No

☐ Unsure

9. Do you have any spray insecticides in your home?

☐ Yes

☐ No

☐ Unsure

10. Have you painted the interior of your home in the last 12 months?

☐ Yes

☐ No

11. Have you painted the exterior of your home in the last 12 months?

☐ Yes

☐ No

12. If you have answered yes to questions 10 or 11, please indicate what paint you used.

☐ Enamel

☐ Vinyl

☐ Latex

☐ Other

Form A-3 – Resident Questionnaire

13. Where do you store your paint, thinner, pesticides, insecticides?

☐ Garage

☐ Basement

☐ Storage shed

☐ Other

☐ I don't store these items at home.

14. Do you have pets?

☐ Yes

☐ No

If yes, what type? _____

If yes, number

Form A-3 – Resident Questionnaire

ATTACHMENT H

Attachment H
Indoor Air Testing Instructions

FORM A-4

INDOOR AIR TESTING INSTRUCTIONS

1. The duration of this test is approximately 24 hours.
2. The canister is made of clean stainless steel. It does not contain any moving parts or chemicals.
3. Please do not handle or move a canister during testing.
4. Please do not smoke around the canister.
5. To the extent possible, leave doors and windows closed during testing.
6. To the extent possible, do not use paint, solvents, glues and spray cans during testing.
7. If possible, do not bring dry cleaning home during the testing.
8. We will be back at the end of the day to pick up the canister about this time.

Canister pick up:

Day _____

Time _____

Thank you for your cooperation.

ATTACHMENT I

Attachment I

REAC SOP #2082

STANDARD OPERATING PROCEDURES

SOP: 2082
Page: 1 of 10
REV: 0.0
DATE: 03/18/04

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

CONTENTS

- 1.0 SCOPE AND APPLICATION
- 2.0 METHOD SUMMARY
- 3.0 EQUIPMENT/APPARATUS
- 4.0 PROCEDURE FOR PROBE ASSEMBLY AND INSTALLATION
- 5.0 PROCEDURE FOR SAMPLING SETUP
- 6.0 PROCEDURE FOR REPAIRING A LOOSE PROBE
- 7.0 APPENDICES

STANDARD OPERATING PROCEDURES

SOP: 2082
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DATE: 03/18/04

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

1.0 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of detecting volatile organic compounds (VOCs) in the soil subsurface. Using this method, underground VOC contamination can be identified, and the source, extent, and movement of pollutants can be traced.

This standard operating procedure (SOP) outlines the methods used for the construction and installation of permanent sub-slab soil gas wells. The wells are utilized to sample the gas contained in the interstitial spaces beneath the concrete floor slab of dwellings and other structures. The thickness of a concrete slab may vary from structure to structure. A structure may have a single slab where the thickness varies. The type of equipment described in this standard operating procedure (SOP) may be purchased at a local home center or hardware store and should allow the installation of a soil gas well in a slab up to 8-inches thick. Equipment can be purchased to drill thru a slab of greater thickness, however this equipment may not be available locally. These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Using an electric Hammer Drill or Rotary Hammer, an inner or pilot hole is drilled into the concrete slab to a depth of approximately 2 inches (") with the 3/8" diameter drill bit. Using the pilot hole as the center, drill an outer hole to an approximate depth of 1 3/8" using the 1" diameter drill bit. Replacing the 3/8" diameter drill bit continue to drill the pilot hole thru the slab and several inches into the sub-slab material. Once drilling is completed, a stainless steel probe is assembled and inserted into the pre-drilled hole. The probe is mounted flush with the surrounding slab so it will not interfere with pedestrian or vehicular traffic and cemented into place. A length of Teflon® tubing is attached to the probe assembly and to a sample container or system. Sample collection may now begin.

3.0 EQUIPMENT/APPARATUS

Hammer Drill or Rotary Hammer
AC extension cord
AC generator (if AC power is not available on site)
Hammer or Rotary Hammer drill bit, 3/8" diameter
Hammer or Rotary Hammer drill bit, 1" diameter
Portable vacuum cleaner
(1) 3/4" open end wrench or (1) medium adjustable wrench
(2) 9/16" open end wrenches or (2) small adjustable wrenches
Hex head wrench, 1/4"
Tubing cutter
Bucket

STANDARD OPERATING PROCEDURES

SOP: 2082
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CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

Trowel or putty knife
Swagelok® SS-400-7-4 Female Connector, 1/4"NPT to 1/4" Swagelok® connector
Swagelok® SS-400-1-4 Male Connector, 1/4"NPT to 1/4" Swagelok® connector
1/4"NPT flush mount hex socket plug, Teflon® coated
1/4"OD stainless steel tubing, pre-cleaned instrument grade
1/4"OD Teflon® tubing
Teflon® thread tape
Anchoring cement (requires water for mixing)
Modeling clay

4.0 PROCEDURE FOR PROBE ASSEMBLY AND INSTALLATION

- Drill a 3/8" diameter inner, or pilot hole to a depth of 2". (Figure 1)
- Using the 3/8" pilot hole as your center, drill a 1" diameter outer hole to a depth of 1 3/8". (Figure 2)
- Vacuum out any cuttings from the hole.
- Continue drilling the 3/8" inner, or pilot hole thru the slab and a few inches into the sub-slab material. (Figure 3)
- Figure 4 details installed probe assembly.
- Vacuum out any cuttings from the outer hole.
- Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, thru the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material. Cut the tubing to the desired length.
- Attach the measured length of 1/4"OD stainless tubing to the female connector with the Swagelok® nut. Tighten the nut.
- Insert the 1/4" hex socket plug into the female connector. Tighten the plug. **Do not over tighten.** If excessive force is required to remove the plug during the sample set up phase the probe may break loose from the anchoring cement.
- Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole.
- Mix a small amount of the anchoring cement. Fill the space between the probe and the outside of the outer hole. Allow the cement to cure according to manufacturers instructions before sampling.

STANDARD OPERATING PROCEDURES

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CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

5.0 PROCEDURE FOR SAMPLING SETUP

Complete the sampling setup (Figure 5) as follows:

- Wrap one layer of Teflon® thread tape onto the NPT end of the male connector.
- Remove the 1/4" hex socket plug from the female connector. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Screw and tighten the male connector into the female connector. **Do not over tighten.** This may cause the probe to break loose from the anchoring cement during this step or when the male connector is removed upon completion of the sampling event. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Attach a length of 1/4"OD Teflon® tubing to the male connector with a Swagelok® nut. The Teflon® tubing is then connected to the sampling container or system to be utilized for sample collection.
- After sample collection remove the male connector from the probe and reinstall the hex socket plug. **Do not over tighten** the hex socket plug. If excessive force is required to remove the plug during the next sampling event the probe may break loose from the anchoring cement. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.

6.0 PROCEDURE FOR REPAIRING A LOOSE PROBE

- If the probe breaks loose from the anchoring cement while removing or installing the hex head plug, or the male connector, lift the probe slightly above the surface of the concrete slab.
- Hold the female connector with the 3/4" open end wrench.
- Complete the step being taken during which the probe broke loose, following the instructions contained in the standard operating procedure (SOP). (i.e. **Do not over tighten** the hex socket plug or male connector)
- Push the probe back down into place and reapply the anchoring cement.
- Modeling clay may be used as a temporary patch to affect a seal around the probe until the anchoring cement can be reapplied.

ATTACHMENT J

Attachment J
Air Sampling Field Form

Air Sampling Field Form

Location	Sample Name	Sample Type	Cannister	Controller	Purge Time (MMDDHHMM)	Sample Time Start (MMDDHHMM)	Sample Time End (MMDDHHMM)	Leak Check	Initial Pressures ("Hg)	Final Pressures ("Hg)

Sampler Name: _____
 Date: _____
 Sample Methodology: _____
 Sample Analytical Method: _____
 Project Number: _____
 Project Name: _____

Comments:

ATTACHMENT K

Attachment K
Property Access and Activity Agreement

Property Access and Activity Agreement

This Agreement is made on _____, 2007 between _____, whose mailing address is _____ and _____ (tenant if applicable) address is _____, Dayton Ohio 45404, hereinafter collectively referred to as "Owner/Tenant" and DaimlerChrysler Corporation ("DCC") whose mailing address is DaimlerChrysler Corporation, c/o Mr. Greg Rose, CIMS 482-00-51, 800 Chrysler Drive, Auburn Hills, Michigan 48326.

1. Owner/Tenant grants access to DCC, its agents, representatives, employees, contractors, subcontractors and DCC's invitees to the property located at _____ Dayton, Ohio 45404 ("Property") at reasonable times and upon reasonable advance notice for the purpose of:
 - a. Inspecting, investigating, documenting and photographing the property and collecting air, soil, groundwater and other samples as necessary for environmental and/or geotechnical testing in accordance with all applicable laws, rules and/or regulations governing same; and
 - b. Installing, operating, maintaining and removing as necessary, environmental testing, recovery and treatment systems at the Property.
2. For purposes of providing notice under this Agreement, the contact person for the Owner/Tenant is _____, phone number _____. The contact person for DCC is Mr. Greg Rose, CIMS 482-00-51, 800 Chrysler Drive, Auburn Hills, Michigan 48326, phone number (248) 576-7362, fax number (248) 576-7369.
3. DCC shall provide Owner/Tenants with a plan outlining the installation of any and all environmental testing, recovery and treatment systems.
4. Ownership of any environmental testing, recovery and treatment system shall vest with the Owner of the Property upon installation. DCC shall not retain any ownership rights of the environmental testing, recovery and treatment system.
5. Prior to installing any environmental testing, recovery and treatment system, DCC shall notify and obtain all necessary approvals from public agencies.
6. All work by DCC or its employees, contractors or subcontractors pursuant to this Agreement shall be conducted in such a manner as to minimize any disruption of or interference Owner/Tenant. No work shall be undertaken which will materially damage buildings, improvements, equipment, or personal property on the Property without Owner/Tenants' prior approval.
7. Owner/Tenants agree that they will not take, or cause to be taken, any action which would interfere or adversely affect the equipment or activities on the Property pursuant to this Agreement.

8. DCC agrees to repair or otherwise correct any property damage caused by the activities of DCC, its employees, contractors or subcontractors on the Property.
9. DCC's contractors and subcontractors working on the Property shall have liability insurance, including comprehensive general liability insurance, of at least \$2 Million per occurrence and will provide adequate proof of such insurance upon request.
10. DCC, by entering into this Agreement, assumes no obligation to the Owner/Tenant(s) to implement and/or continue the activities described in this Agreement.
11. DCC shall provide \$150 to Owner/Tenant for electrical charges incurred as a result of the operation of the environmental testing, recovery and treatment system for the period of December 1, 2006 through December 1, 2008. On or before December 1, 2008, DCC and Owner/Tenants shall re-evaluate electrical charges and reasonably adjust future payments by DCC for same.
12. Except as expressly provided in this Agreement, neither party by entering into this Agreement waives any right it may have against the other party, or any other person or entity relating to the release or threatened release of hazardous or regulated substances under all applicable federal, state and/or local laws, rules or regulations.
13. This Agreement is governed by Michigan Law.
14. This Agreement shall be effective on the first date it is fully executed and expires at midnight on December 1, 2018, or whenever the environmental testing, recovery and treatment system is no longer required as dictated by U.S. EPA, whichever occurs first.
15. If this Agreement is executed in duplicate, both are deemed originals.

OWNER/TENANT

By: _____

Date: _____

DaimlerChrysler Corporation

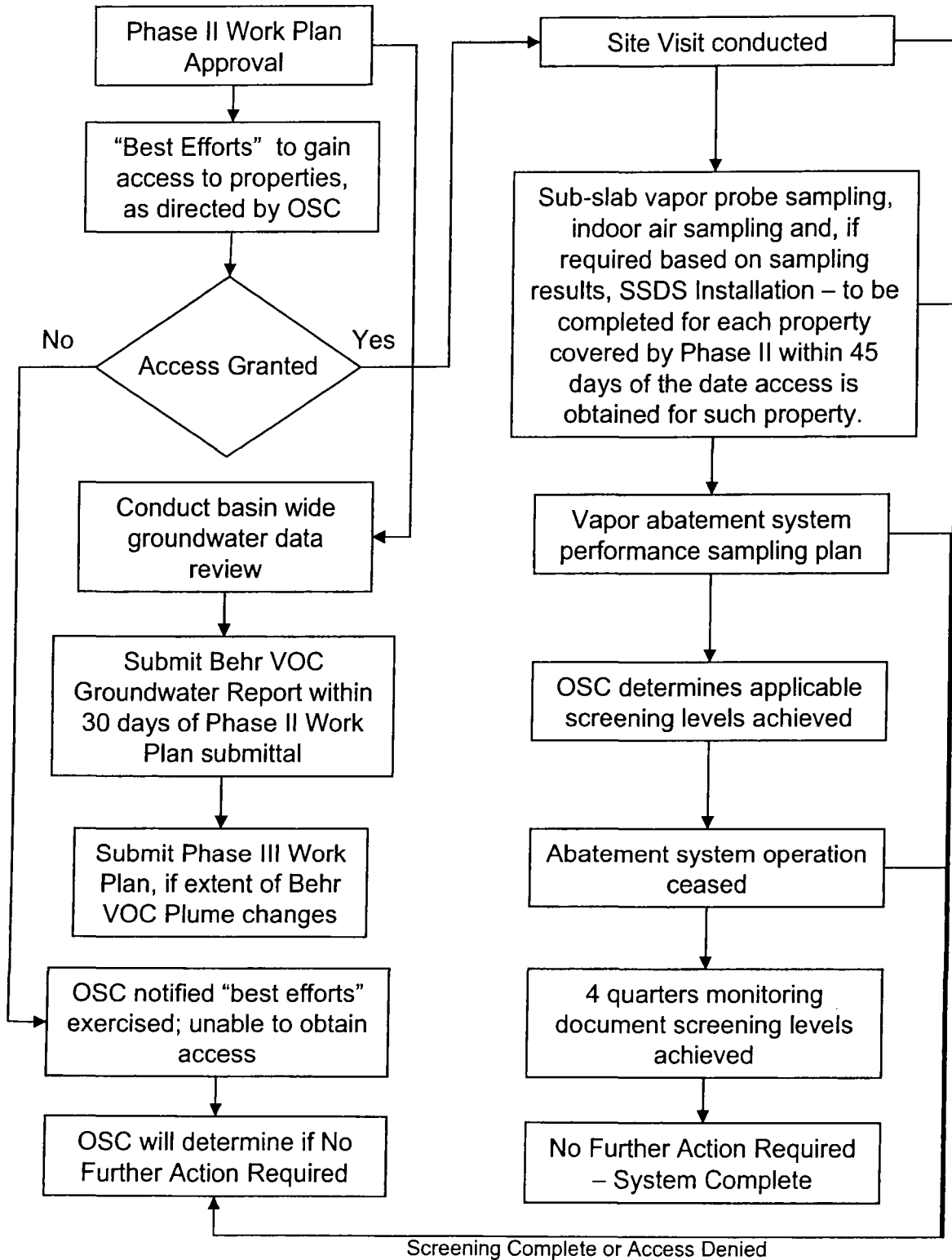
By: _____

Date: _____

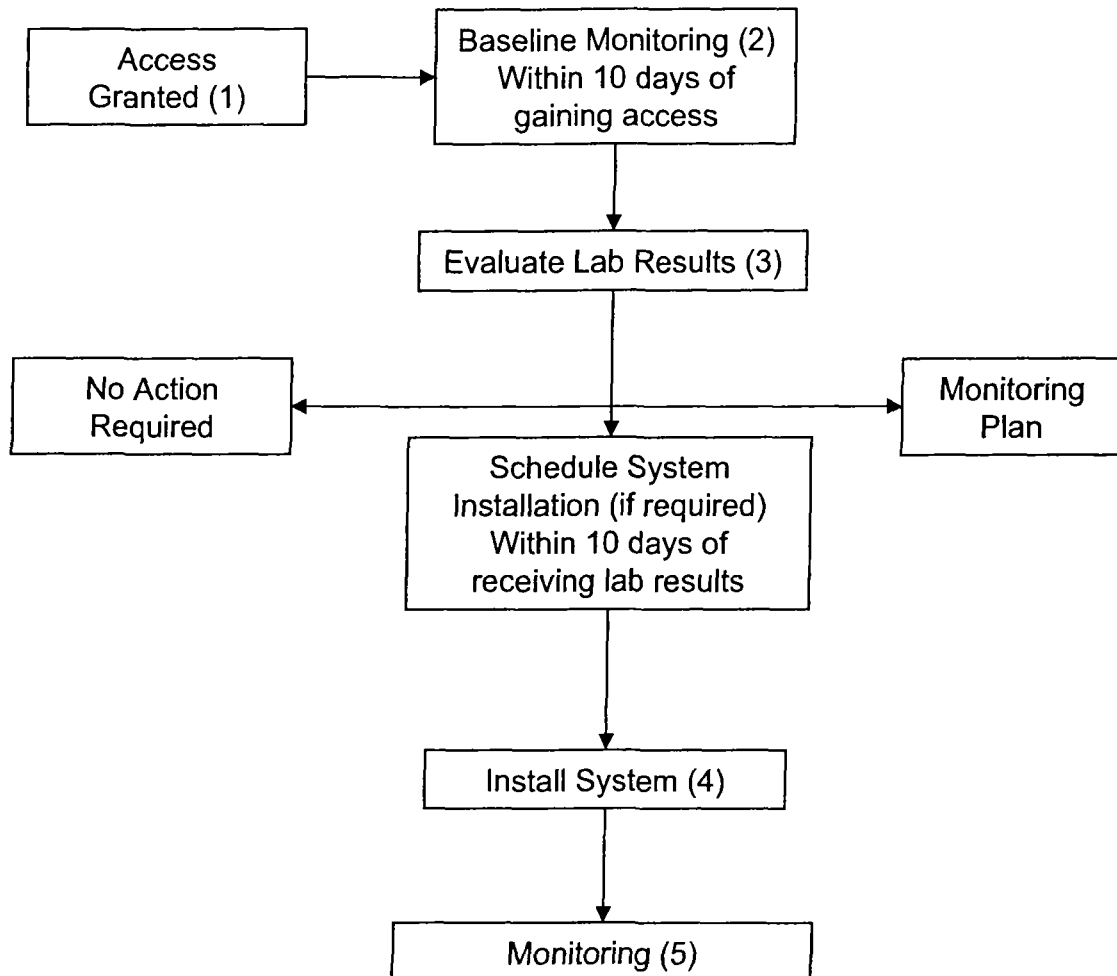
ATTACHMENT L

Attachment L
Project Schedule

**Site Access And Sampling
Schedule – Behr VOC Plume Site
Dayton, Ohio**



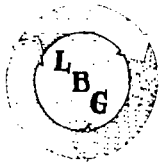
Project Schedule – Behr VOC
Plume Site
Dayton, Ohio



- (1) See Access Plan (Section 4.3)
- (2) As scheduled/agreed with resident (Section 4.4)
- (3) See Section 4.5
- (4) See Section 5
- (5) See Section 6



349885


**LEGGETTE, BRASHEARS
& GRAHAM, INC.**

Professional Ground-Water Consultants

JOB

17771

TIME

1:27

DATE

12/1/99

CONTACT NAME

John Jensen

FIRM

R.B. Jensen Consulting

PHONE NO.

937-661-9199

DISCUSSION

Called Leggett about cost to remove soils - the
company price.

Loading and trucking @ \$6.50 cu/yd x 30,000 cu/yd = \$195,000

Stoney Hollow Landfill @ \$20.00 cu/yd x 30,000 cu/yd =
\$600,000

They go by truck box size not the actual amount
of dirt in the truck.

Place the dirt away from Port District needs 17,200 cu/yd
for a bike trail along the Miami River.

Ash from Inverness Borrow pit. - John is having their
engineer look into it.

ACTION

G.M. has a heavy dirt hauler to Stoney Hollow because
of heavy issues.

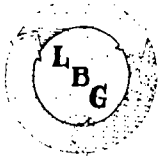
10/20/99 - R.B. Jensen - Kevin - called to confirm -

Cell # - 937-773-7676

Cell # 937-763-7676

12/8/99 12:30

Called Kevin in regards to getting an estimate to haul
the Dayton soil piles to Toledo, OH.



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB

DP 47W

TIME

DATE

10/22/73

CONTACT NAME

Harold Simon

22-0

FIRM

Leggett, Brashears & Graham, Inc.

PHONE NO.

514-435-5252

DISCUSSION

City, - Marketing

- No car per mile - car cost 25,000 cu. ft.

- Cost per ton to area - quite expensive -

- NS -

- CSX -

12 days for quote

CSX - 800-525-5476

CSX - 800-327-3307

Jack: 11/1/73

- Jim Githan - Minerals - Transferred me to someone else

DAYTON - Detroit -

CSX - Mike Simon, JR - 800-374-3437

ACTION

337 RR Cars - 200,000 lbs - each gondola

To Detroit from Dayton - cost



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB DAVCO
TIME 3:15 DATE 10/1/90
CONTACT NAME Spencer Co. Inc.
FIRM Spencer Co. Inc.
PHONE NO. 237-262-1111 / 512-770-030

DISCUSSION

Calculation of disposal costs
for solid waste at DAVCO.

Construction Debris \$12.50 ton - disposal x 33,750 tons = 421,875
\$5.00 ton - trucking
= 168,750
Solid Waste 25.00 ton x 25,000 tons = 625,000
33,750 tons = \$1,215,625

ACTION

- Send analytical data
- Summary of soil analysis

FAX # 237-262-1111

Big Foot landfill - 1000 ft. - see site

**DAIMLERCHRYSLER
DAYTON THERMAL PRODUCTS
THE DIRT ON THE DIRT**

STONE HOLLOW LANDFILL	25,000 CUBIC YARDS ~ 33,750 TONS
CONTACT: SPENCER SOUTH	
DISPOSAL COSTS	
CONSTRUCTION DEBRIS	\$12.50 / TON X 33,750 TONS = \$421,875
SOLID WASTE	\$25.00 / TON X 33,750 TONS = \$843,750
R.B. JERGENS CONSTRUCTION	
LOADING AND HAULING	\$6.50 / YARD X 25,000 YARDS = \$195,000
	~\$616,875

RAIL TRANSPORT	
DAYTON TO DETROIT	\$12.89 / TON X 33,750 TONS = \$435,038
	+ LOADING AND UNLOADING + TRUCKING TO SITE
LOADING (ROUGH) ESTIMATE	50 CU/YD/HOUR
	$\frac{25,000 \text{ CU/YD}}{50 \text{ CU/YD/HOUR}} = 500 \text{ HRS} \times \$125/\text{HR} = \$62,500$
UNLOAD / TRUCKING	\$195,000 ?????
	~\$692,538

LOAD AND HAUL TO TOLEDO	
R.B. JERGENS CONSTRUCTION	
JEEP PLANT	\$18.90/TON X 33,750 TONS = \$637,875
CHRY. PLANT ON RT. 23	\$20.15/TON X 33,750 TONS = \$680,062

TABLE 6

DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO

STOCKPILED SOILS

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

VOLATILE ORGANIC COMPOUNDS

NO TCLP VOLATILE ORGANIC COMPOUNDS WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMIT OF 50 ug/L
IN THE SP-1-CP-1 COMPOSITE SAMPLE

NO TCLP VOLATILE ORGANIC COMPOUNDS WERE ANALYSED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

SEMI-VOLATILE ORGANIC COMPOUNDS

NO TCLP SEMI-VOLATILE ORGANIC COMPOUNDS WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMITS OF 50 AND 250 ug/L
IN THE SP-1-CP-1 COMPOSITE SAMPLE

NO TCLP SEMI-VOLATILE ORGANIC COMPOUNDS WERE ANALYSED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

PESTICIDE ORGANICS

NO TCLP PESTICIDE ORGANICS WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMITS OF 0.25 TO 25 ug/L
IN THE SP-1-CP-1 COMPOSITE SAMPLE

NO TCLP PESTICIDES WERE ANALYSED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

HERBICIDE ORGANICS

NO TCLP HERBICIDE ORGANICS WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMITS OF 2.5 AND 7.5 ug/L
IN THE SP-1-CP-1 COMPOSITE SAMPLE

NO TCLP HERBICIDES WERE ANALYSED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

METALS (mg/L)

SEE TABLE 3 FOR TCLP METAL CONCENTRATIONS

TABLE 3

**DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO**

STOCKPILED SOILS

TOTAL AND TCLP METALS

TOTAL METALS (mg/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM*	LEAD	MERCURY	SELENIUM	SILVER	ZINC	COPPER
VAP RESIDENTIAL LIMITS mg/kg			6.9	5,000	32	230	400	16	—	—	19,000	—
VAP INDUSTRIAL LIMITS mg/kg			86	140,000	300	2,800	2,800	230	—	—	370,000	—
SP-1 - SB-1	4-6'	9/15/98	6.9	53.7	0.73	12.9 E	26.4 E	<0.06 N	0.67 N	<0.07	---	---
SP-1 - SB-2	4-5'	9/15/98	8.5	51.1	1.7	15.3 E	17.9 E	<0.06 N	<0.57 N	<0.07	---	---
SP-1 - SB-3	4-5'	9/15/98	7.1	50.5	1.0	10.7 E	17.7 E	1.8 N	<0.56 N	<0.06	---	---

TCLP METALS (mg/L)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER	ZINC	COPPER
MAXIMUM TCLP CONCENTRATION (mg/L)			5	100	1	5	5	0.2	1	5	—	—
SP-1 - CP-1	COMPOSITE	9/15/98	< 0.0037	0.343	0.0044 B	0.0012 B	0.0121	< 0.0001	0.0205 N	< 0.0006	---	---
SP01TP01	9'	7/27/99	< 0.007	0.52	0.002	< 0.0054	< 0.023	< 0.00004	0.0074 J	< 0.0057	0.05	< 0.0058
SP01TP02	9'	7/27/99	< 0.007	0.48	0.0018	0.0107 J	< 0.023	< 0.00004	< 0.0059	< 0.0057	0.03	0.0089 J
SP01TP03	9'	7/27/99	< 0.007	0.57	0.0024	< 0.0054	< 0.023	< 0.00004	0.006 J	< 0.0057	0.071	< 0.0058
SP01TP04	9'	7/27/99	< 0.007	0.65	0.0024	< 0.0054	0.028 J	0.000069 J	< 0.0059	< 0.0057	0.167	0.0111 J
SP01TP05	9'	7/27/99	< 0.007	0.47	0.0017	< 0.0054	< 0.023	< 0.00004	0.0072 J	< 0.0057	0.054	< 0.0058
SP02TP01	8'	7/28/99	< 0.007	0.63	0.0027	< 0.0054	< 0.023	< 0.00004	< 0.0059	< 0.0057	0.207	0.01 J
SP02TP02	8'	7/28/99	< 0.007	0.63	0.0025	< 0.0054	< 0.023	< 0.00004	0.0061 J	< 0.0057	0.1	0.009 J
SP02TP03	8'	7/28/99	< 0.007	0.68	0.0032	< 0.0054	0.27	< 0.00004	< 0.0059	< 0.0057	0.179	0.0225 J
SP02TP04	8'	7/28/99	< 0.007	0.54	0.0025	< 0.0054	< 0.023	< 0.00004	< 0.0059	< 0.0057	0.082	0.0235 J
SP02TP05	8'	7/28/99	< 0.007	0.6	0.0024	< 0.0054	< 0.023	0.000048 J	< 0.0059	< 0.0057	0.125	0.0093 J
SP03TP01	1.5'	7/28/99	< 0.007	0.85	0.004	< 0.0054	0.05 J	< 0.00004	0.0067 J	< 0.0057	0.081	0.014 J
SP03TP02	4'	7/28/99	< 0.007	0.78	0.002	< 0.0054	0.029 J	< 0.00004	< 0.0059	< 0.0057	0.055	0.0241 J

ONLY TCLP METALS WERE ANALYZED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02. SEE TABLE 7 FOR TCLP METALS.

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS "GENERIC DIRECT-CONTACT SOIL STANDARDS" 1998-2 EDITION

TCLP: TOXICITY CHARACTERISTIC LEACHING PROCEDURE

--- NOT ESTABLISHED OR NOT ANALYZED

B: ANALYTE WAS FOUND IN THE ASSOCIATED BLANK AS WELL AS THE SAMPLE.

E: ESTIMATED VALUE (SEE REPORT QUALIFIERS)

J: ESTIMATED VALUE

N: SAMPLE SPIKE RECOVERY IS OUTSIDE OF CONTROL LIMITS

<: LESS THAN

SB: SOIL BORING

SP: SOIL PILE

TP: TEST PIT

CP: COMPOSITE SAMPLE OF SB-1, SB-2, AND SB-3

* CHROMIUM LIMITS BASED ON CHROMIUM VI: CHROMIUM III RESIDENTIAL = 8,800 mg/kg; INDUSTRIAL = 63,000 mg/kg

AREAS HIGHLIGHTED IN YELLOW REPRESENT EXCEEDENCES OVER THE VAP RESIDENTIAL LIMIT

MAXIMUM TCLP CONCENTRATION OF CONTAMINANTS PER OHIO EPA HAZARDOUS WASTES CHAPTER 3745-51-24, TABLE 1 OF OHIO EPA REGULATIONS VOLUME TWO, 1998-2 EDITION.

TABLE 4

DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO

STOCKPILED SOILS

SUMMARY OF POSITIVE DETECTIONS IN SOIL
PESTICIDE ORGANICS
CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	SAMPLE DATE	DILUTION	ALPHA BHC	GAMMA BHC (LINDANE)	4,4'-DDE	4,4'-DDT	4,4'-DDD	DIELDRIN	ENDOSULFAN II	ENDOSULFAN	HEPTACHLOR	HEPTACHLOR EPOXIDE	ENDRIN KETONE	METHOXYCHLOR	ALPHA CHLORDANE	GAMMA CHLORDANE	ENDRIN	ENDRIN ALDEHYDE
VAP INDUSTRIAL LIMITS ug/kg																			
SP-1 - SB-1	4'-6'	9/15/98	1.0	<1.9	0.88 JP	1.5 JP	<11	<7.6	0.36 JP	0.88 J	<7.6	0.67 JP	<1.9	<19	<19	---	---	<7.6	<7.6
SP-1 - SB-2	4'-5'	9/15/98	1.0	<1.9	0.39 JP	<4.0	0.67 JP	<7.7	0.49 JP	<7.7	1.5 JP	<1.9	<1.9	2.3 JP	11 JP	---	---	<7.7	<7.7
SP-1 - SB-3	4'-5'	9/15/98	1.0	0.26 JP	0.88 JP	<4.0	0.80 JP	<7.7	0.77 JP	<7.7	1.7 JP	<1.9	0.41 JP	3.1 JP	12 JP	---	---	<7.7	<7.7
SP01TP01	9'	7/27/99	10.0	<0.79	<0.79	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<0.79	1.49 J	<1.5	36.1 J	<0.79	1.76 J	<1.5	<1.5
SP01TP02	9'	7/27/99	10.0	<0.79	<0.79	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<0.79	<0.79	<1.5	<7.9	<0.79	<0.79	<1.5	<1.5
SP01TP03	9'	7/27/99	10.0	<0.78	<0.78	<1.5	4.3 J	<1.5	<1.5	<1.5	<1.5	<0.78	<0.78	<1.5	58	<0.78	<0.78	<1.5	<1.5
SP01TP04	9'	7/27/99	10.0	<0.8	<0.8	<1.5	17.0	<1.5	<1.5	<1.5	<1.5	<0.8	2 J	<1.5	16 J	<0.8	<0.8	2.1 J	<1.5
SP01TP05	9'	7/27/99	10.0	<0.78	<0.78	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<0.78	<0.78	<1.5	9.3 J	<0.78	<0.78	<1.5	<1.5
SP02TP01	8'	7/28/99	10.0	1.08 J	<0.78	<1.5	2.6 J	<1.5	<1.5	<1.5	<1.5	<0.78	<0.78	<1.5	112	<0.78	13.4	<1.5	2.7 J
SP02TP02	8'	7/28/99	10.0	<0.74	<0.74	<1.4	14.8	<1.4	<1.4	<1.4	<1.4	<0.74	2.13 J	<1.4	52	<0.74	8.2	2.6 J	<1.4
SP02TP03	8'	7/28/99	10.0	<0.74	<0.74	<1.5	15	11.8	<1.5	<1.5	<1.5	1.29 J	0.97 J	<1.5	145	<0.75	24.6	<1.5	2.9 J
SP02TP04	8'	7/28/99	10.0	<0.74	<0.74	<1.4	6.2 J	3.3 J	<1.4	<1.4	<1.4	<0.74	<0.74	<1.4	62	<0.74	5.5	<1.4	<1.4
SP02TP05	8'	7/28/99	10.0	1.39 J	<0.75	<1.5	21.6	18.2	<1.5	<1.5	<1.5	7.1	<0.75	<1.5	136	60.4	50.5	<1.5	2 J
SP03TP01	1.5'	7/28/99	10.0	<0.7	<0.7	<1.4	11.6	<1.4	<1.4	<1.4	<1.4	<0.7	1.66 J	1.8 J	<7	<0.7	1.7 J	<1.4	<1.4
SP03TP02	4'	7/28/99	10.0	<0.74	<0.74	<1.4	10.5	<1.4	<1.4	<1.4	<1.4	<0.74	1.26 J	<1.4	22.3 J	<0.74	<0.74	<1.4	<1.4

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS "GENERIC DIRECT-CONTACT SOIL STANDARDS" 1998-2 EDITION

---: NOT ESTABLISHED

B: ANALYTE WAS FOUND IN THE ASSOCIATED BLANK AS WELL AS THE SAMPLE

J: ESTIMATED VALUE

P: GREATER THAN 25% DIFFERENCE FOR DETECTED CONCENTRATIONS BETWEEN THE TWO GC/MS COLUMNS THE LOWER VALUE IS REPORTED.

SP: SOIL PILE

SB: SOIL BORING

TP: TEST PIT

< LESS THAN

TABLE 5
DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO
STOCKPILED SOILS
PCBs AND HERBICIDES
CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/kg)

POLYCHLORINATED BIPHENYLS PCBs

NO PCBs WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMIT OF 26 TO 49 ug/kg
IN THE SP-1-SB-1, SP-1-SB-2, SP-1-SB-3 SAMPLES OR THE SP-1-CP-1 COMPOSITE SAMPLE

NO PCBs WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMIT OF 34 TO 39 ug/kg
IN SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

HERBICIDE ORGANICS

NO HERBICIDE ORGANICS WERE DETECTED ABOVE THE LABORATORY METHOD DETECTION LIMIT OF 2.3 TO 5.8 ug/kg
IN THE SP-1-SB-1, SP-1-SB-2, AND SP-1-SB-3 SAMPLES

NO HERBICIDE ORGANICS WERE ANALYZED FOR SAMPLES SP01TP01 - SP01TP05, SP02TP01 - SP02TP05, SP03TP01 - SP03TP02

TABLE 2

DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO

STOCKPILED SOILS

SUMMARY OF POSITIVE DETECTIONS IN SOIL
SEMI-VOLATILE ORGANIC COMPOUNDS
CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	SAMPLE DATE	DILUTION FACTOR	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (b) FLUORANTHENE	BENZO (k) FLUORANTHENE	BENZO (ghi) PERYLENE	BENZO (a) PYRENE	CARBAZOLE	CHRYSENE	INDENO (1,2,3-cd) PYRENE	FLUORANTHENE	PHENANTHRENE	PYRENE
VAP RESIDENTIAL LIMITS ug/kg				9,500,000	5,500	5,500	55,000	—	550	—	550,000	5,500	1,300,000	—	950,000
VAP INDUSTRIAL LIMITS ug/kg				89,000,000	31,000	31,000	310,000	—	3,100	—	3,100,000	31,000	12,000,000	—	8,900,000
SP-1 - SB-1	4-6'	9/15/98	1.0	75 J	300 J	380	130 J	140 J	250 J	53 J	290 J	140 J	610	370 J	420
SP-1 - SB-2	4-5'	9/15/98	1.0	<380	58 J	76 J	<380	<380	54 J	<380	62 J	<380	100 J	54 J	70 J
SP-1 - SB-3	4-5'	9/15/98	1.0	<380	110 J	110 J	76 J	46 J	71 J	<380	110 J	47 J	250 J	150 J	180 J
SP01TP01	9'	7/27/99	1.0	230 J	680	660	280 J	250 J	470	100 J	680	280 J	1400	830	1200
SP01TP02	9'	7/27/99	1.0	< 39	150 J	180 J	77 J	79 J	130 J	< 39	140 J	88 J	280 J	170 J	260 J
SP01TP03	9'	7/27/99	1.0	76 J	300 J	320 J	140 J	120 J	220 J	< 39	310 J	140 J	520	320 J	470
SP01TP04	9'	7/27/99	1.0	260 J	660	820	340 J	400	620	97 J	640	480	1300	860	1200
SP01TP05	9'	7/27/99	1.0	54 J	250 J	250 J	100 J	120 J	180 J	< 38	240 J	130 J	390	210 J	380 J
SP02TP01	8'	7/28/99	1.0	580	1600	1700	670	710	1200	310 J	1600	830	3400	2400	3200
SP02TP02	8'	7/28/99	1.0	370	1100	1200	530	570	910	200 J	1200	650	2400	1600	2200
SP02TP03	8'	7/28/99	1.0	1300	2800	2800	1100	1300	2300	340 J	2700	1500	6100	3900	5400
SP02TP04	8'	7/28/99	1.0	240 J	760	930	360 J	390	640	140 J	780	450	1500	1000	1400
SP02TP05	8'	7/28/99	1.0	950	2700	3200	1300	1500	2400	570	2700	1700	6200	4200	5400
SP03TP01	1.5'	7/28/99	1.0	240 J	850	1100	480	580	880	88 J	850	670	1600	900	1500
SP03TP02	4'	7/28/99	1.0	210 J	750	1000	420	590	810	100 J	710	650	1600	920	1500

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS *GENERIC DIRECT-CONTACT SOIL STANDARDS* 1998-2 EDITION

---: NOT ESTABLISHED

J: ESTIMATED VALUE

<: LESS THAN

SP: SOIL PILE

SB: SOIL BORING

TP: TEST PIT

AREAS HIGHLIGHTED IN YELLOW REPRESENT EXCEEDENCES OVER THE VAP RESIDENTIAL LIMIT

TABLE 1

DAYTON THERMAL PRODUCTS PLANT
DAYTON, OHIO

STOCKPILED SOILS

SUMMARY OF POSITIVE DETECTIONS IN SOIL
VOLATILE ORGANIC COMPOUNDS
UNITS ARE IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	DATE	DILUTION FACTOR	1,1-DICHLORO-ETHANE	1,2-DICHLORO-ETHANE (TOTAL)	TRICHLORO-ETHENE	TETRACHLORO-ETHENE	ACETONE	METHYLENE CHLORIDE	DIESEL RANGE ORGANICS	TOTAL PETROLEUM HYDROCARBONS	1,1,1-TRICHLOROETHANE	CIS-1,2-DICHLOROETHENE	TRANS-1,2-DICHLOROETHENE	CHLOROFORM
VAP RESIDENTIAL LIMITS ug/kg				620,000	—	77,000	94,000	4,500,000	220,000	—	—	1,200,000	450,000	910,000	—
VAP INDUSTRIAL LIMITS ug/kg				2,300,000	—	330,000	370,000	55,000,000	990,000	—	—	1,400,000	1,200,000	2,500,000	—
SP-1 - SB-1	4-6'	9/15/98	1.0	<11	<23	5 J	1 J	3 JB	8 JB	<57,000	108,000	<11	—	—	<11
SP-1 - SB-2	4-5'	9/15/98	1.0	<12	4 J	1 J	<12	2 JB	9 JB	<58,000	93,200	<12	—	—	<12
SP-1 - SB-3	4-5'	9/15/98	1.0	1 J	3 J	10 J	1 J	4 JB	9 JB	<58,000	325,000	<12	—	—	<12
SP-1 - CP-1	COMPOSITE	9/15/98	---	---	---	---	---	---	---	---	120,000	---	---	---	---
T-0001	---	9/15/98	1.0	<10	<20	<10	<10	2 JB	10 B	---	---	<10	---	---	<10
SP01TP01	9'	7/27/99	1.0	11	11	32	2 J	19 J	10	---	---	2 J	11	<2	<1
SP01TP02	9'	7/27/99	1.0	2 J	<4	5 J	2 J	<8	3 J	---	---	2 J	<2	<2	<1
SP01TP03	9'	7/27/99	1.0	<1	<4	12	<1	<8	9	---	---	<1	<2	<2	<1
SP01TP04	9'	7/27/99	1.0	<1	8	4 J	<1	18 J	11	---	---	<1	8	<2	<1
SP01TP05	9'	7/27/99	1.0	5 J	3 J	9	2 J	<8	9	---	---	6	3 J	<2	<1
SP02TP01	8'	7/28/99	1.0	<1	<4	87	<1	<8	31	---	---	2 J	<2	<2	1 J
SP02TP02	8'	7/28/99	1.0	<1	<4	23	<1	<8	5 J	---	---	<1	<2	<2	<1
SP02TP03	8'	7/28/99	1.0	<1	<4	31	1 J	<8	11	---	---	<1	<2	<2	<1
SP02TP04	8'	7/28/99	1.0	<1	<4	20	1 J	<8	14	---	---	<1	<2	<2	<1
SP02TP05	8'	7/28/99	1.0	<1	<4	16	<1	<8	25	---	---	<1	<2	<2	<1
SP03TP01	1.5'	7/28/99	1.0	<1	<4	<1	<1	9 J	12	---	---	<1	<2	<2	<1
SP03TP02	4'	7/28/99	1.0	<1	<4	18	19	<8	7	---	---	<1	<2	<2	<1

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS "GENERIC DIRECT-CONTACT SOIL STANDARDS" 1998-2 EDITION
---: NOT ESTABLISHED OR NOT ANALYZED

B: ANALYTE WAS FOUND IN THE ASSOCIATED BLANK AS WELL AS THE SAMPLE.

J: ESTIMATED VALUE

<: LESS THAN

SP: SOIL PILE

SB: SOIL BORING

TP: TEST PIT

CP: COMPOSITE SAMPLE OF SB-1, SB-2, AND SB-3

T-0001: TRIP BLANK

S: TECHACHRY/DAYTONANALYTICAL
Sample V001's
10/15/98 1:27 PM

TABLE 2

DAYTON THERMAL PRODUCTS
DAYTON, OHIO

STOCKPILE SOILS

SUMMARY OF POSITIVE DETECTIONS IN SOIL
SEMI-VOLATILE ORGANIC COMPOUNDS
CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	SAMPLE DATE	DILUTION FACTOR	ACENAPHTHENE	ACENAPHTHYLENE	FLUORENE	DIBENZO (a,h) ANTHRACENE	NAPHTHALENE	2-METHYLNAPHTHALENE	DIBENZOFURAN	2-METHYLPHENOL	PHENOL	3,3-DICHLOROBENZIDINE	BIS (2-ETHYLHEXYL) PHTHALATE
VAP RESIDENTIAL LIMITS ug/kg				1,900,000	—	1,300,000	550	1,800,000	—	—	—	26,000,000	—	150,000
VAP INDUSTRIAL LIMITS ug/kg				1,800,000	—	12,000,000	3,100	22,000,000	—	—	—	300,000,000	—	860,000
SP-1 - SB-1	4-6'	9/15/98	1.0	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 760	< 380
SP-1 - SB-2	4-5'	9/15/98	1.0	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 770	< 380
SP-1 - SB-3	4-5'	9/15/98	1.0	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 380	< 770	< 380
SP01TP01	9'	7/27/99	1.0	46 J	< 39	56 J	88 J	< 39	< 39	< 39	< 39	< 79	< 79	< 79
SP01TP02	9'	7/27/99	1.0	< 39	< 39	< 39	< 39	< 39	< 39	< 39	< 39	< 79	< 79	< 79
SP01TP03	9'	7/27/99	1.0	< 39	< 39	< 39	40 J	< 39	< 39	< 39	< 39	< 78	< 78	< 78
SP01TP04	9'	7/27/99	1.0	58 J	90 J	110 J	120 J	110 J	48 J	82 J	< 39	< 80	< 80	< 80
SP01TP05	9'	7/27/99	1.0	< 38	< 38	< 38	41 J	< 38	< 38	< 38	< 38	< 78	< 78	< 78
SP02TP01	8'	7/28/99	1.0	150 J	< 38	190 J	210 J	70 J	63 J	130 J	< 38	< 78	< 78	< 78
SP02TP02	8'	7/28/99	1.0	99 J	< 36	110 J	160 J	40 J	43 J	69 J	< 36	< 74	< 74	< 74
SP02TP03	8'	7/28/99	1.0	240 J	46 J	310 J	360 J	150 J	77 J	170 J	< 37	< 75	< 75	< 75
SP02TP04	8'	7/28/99	1.0	62 J	< 37	75 J	130 J	43 J	< 37	56 J	< 37	< 74	< 74	< 74
SP02TP05	8'	7/28/99	1.0	330 J	70 J	300 J	400	110 J	90 J	210 J	< 37	2500	180 J	460
SP03TP01	1.5'	7/28/99	1.0	55 J	200 J	77 J	150 J	93 J	46 J	52 J	120 J	< 70	< 70	< 70
SP03TP02	4'	7/28/99	1.0	52 J	130 J	81 J	150 J	95 J	76 J	60 J	< 36	< 74	< 74	180 J

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGUL

---: NOT ESTABLISHED

J: ESTIMATED VALUE

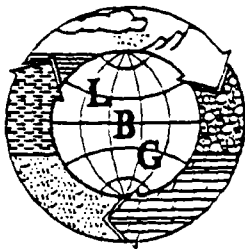
<: LESS THAN

SP: SOIL PILE

SB: SOIL BORING

TP: TEST PIT

AREAS HIGHLIGHTED IN YELLOW REPRESENT EXCEED



LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUND-WATER
AND ENVIRONMENTAL ENGINEERING SERVICES

1210 WEST COUNTY ROAD E
SAINT PAUL, MN 55112

(651) 490-1405 FAX (651) 490-1006

DATE: 10/20/99

PAGES: 9
(Includes cover page)

TO: Spencer South

FAX #:

COMPANY: Stoney Hollow

TO:

FAX #:

COMPANY:

TO:

FAX #:

COMPANY:

FROM: Dane Olson

RE: Dayton Thermal Products

Spencer,

This is a synopsis of the soil piles with
the analytical data. Please let me know the
status of the soils. Feel free to call if you have
questions.

Thanks,

Dane

Please contact Kathleen Weinrich (651) 490-1405 if transmission is incomplete or can not be read.

Ex. 204

fax

TRANSMITTAL

10/20/99

[REDACTED]

pulling down some of the soil embankment (figure 4). Soil Pile #3 was accessible from the side

SOIL PILE DESCRIPTION

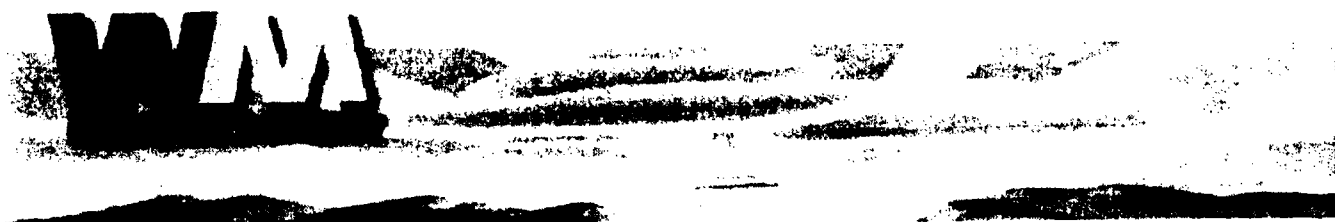
Soil Pile #1 is approximately 9 feet deep, 400 feet long (north-south), 200 feet wide (east-west), and is estimated by LBG to be approximately 8,500 yd³. It is steep walled, flat on top, and covered with a plastic liner overlain by approximately 3 inches of 0.5 to 2-inch diameter aggregate. It has an even mixture of clay, silt, sand and gravel, and historically contained no visible staining. The soil was wet to saturated. This soil pile is the combination of 3 historical soil piles (TPH, VOC, fourth). Some of the old SVE piping was encountered with the backhoe at SP01TP04. Photos 1 through 3 present different views of Soil Pile #1.

Soil Pile #2 is approximately 8 feet tall, 190 feet wide, 310 feet long, and is estimated by LBG to be approximately 14,500 yd³. It is steep walled, flat on top, underlain by plastic sheeting, and covered with 3 to 5-foot high plant growth (i.e. grasses, weeds, small trees). The soil is a mixture of clay, silt, and sand with some gravel. The soil was considerably dryer than Soil Pile #1. There is a 1 to 2-foot high berm surrounding the soil pile to control runoff. Photos 4 through 7 present different views of Soil Pile #2.

Soil Pile #3 is approximately 20 feet tall, conical in shape with steep sides, very hard and dry, and was surrounded by unused plant equipment. This pile is estimated by LBG to be approximately 1,000 yd³. This pile is a mixture of silt, sand and gravel, but also contains large amounts of concrete and other construction debris (brick, piping, etc.). Photo 8 presents a view of Soil Pile #3.

SOIL SAMPLE COLLECTION

The test pits dug in Soil Piles #1 and #2 were approximately 9 feet and 8 feet deep, respectively, near the base of each soil pile. Test pits were dug at each corner of the soil piles with one near the center of the pile to obtain representative soil samples. When the backhoe reached the base of the soil piles a final scoop was lifted and samples were collected directly from the backhoe bucket and placed in laboratory supplied clear 4 and 8 ounce glass jars sealed with Teflon coated lids. Samples were screened by the onsite hydrogeologist with a photoionization detector (PID)

**Areas**

ATLANTIC AREA OFFICE
1275 North Service Road West
Unit 700
Oakville, ON L6M 3G4
Canada
Phone: (905) 825-8040
Fax: (905) 825-5603

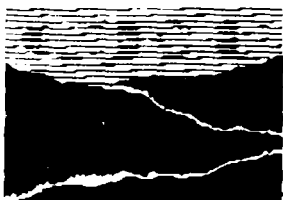
EASTERN AREA OFFICE
Park West Two, Suite 420
2000 Cliff Mine Road
Pittsburgh, PA 15275
Phone: (412) 494-4966
Fax: (412) 490-0168

MIDWEST AREA OFFICE
720 East Butterfield Road
Lombard, IL 60148
Phone: (630) 572-8800
Fax: (630) 572-8182

SOUTHERN AREA OFFICE
2410 Paces Ferry Road
Suite 400
Atlanta, GA 30339
Phone: (770) 805-4130
Fax: (770) 805-9145

WESTERN AREA OFFICE
155 North Redwood Drive
Suite 250
San Rafael, CA 94903
Phone: (415) 479-3700
Fax: (415) 479-3737

1712-512-6-00 - Houston
Copy



CARLO ENVIRONMENTAL TECHNOLOGIES, INC.

21570 HALL RD.

• CLINTON TWP., MICHIGAN 48038-0744 • (810) 465 6232 • FAX (810) 465 5571
800.465.6234

LETTER OF TRANSMITTAL cell/voice MAIL 313.618.1010

TO: Ken Vogel
LBG
via fax 651.490.1006DATE: 2/9/98
PROJECT: Chrysler Dayton
RE: Dirt To Toledo.

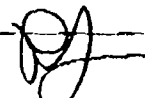
ATTN: _____

Gentlemen:

We are transmitting the following to you:

☐ Attached☒ For Your File☐ For Processing☐ For Your Approval☐ For Review & Comment☐ Per Your Request

REMARKS: Confirming our conversation end of last week:
After detailed tabulation, our price to load, truck and
dump 8,700 yd³, our price is 32⁰⁰/yd trucked. By
showing profit margin and increasing productivity
assumptions, further tabulation might get us down to
29⁰⁰ ±. As you mentioned, this project is likely to go no
further. Let me know if you wish to re-visit the topic
at any time.

Thanks. 

Very truly yours,
CARLO ENVIRONMENTAL
TECHNOLOGIES, INC.

Copy To: G. Stanczak.BY _____
PATRICK J. STOCK

RECORD OF TELEPHONE CONVERSATION

DATE: 1/4/99 NAME: DVS ☒ INCOMING ☐ OUTGOING

NAME OF PERSON CALLING/CALLED: Eric Alden ? Aldrich?

COMPANY/TITLE: Philips

PHONE NUMBER: _____

CLIENT: 3 chry4 / Dayton TIME IN: 8:45 TIME OUT: 8:55

DETAILS OF CONVERSATION: Re: 40B drilling for free-phase product

EA = looking over bid from and has concerns bidding on
a per foot basis, would like to bid per hour
because of unknowns they may encounter drilling
inside

DVS = Nope, need a per foot bid

EA = Also, would they be able to use an all-terrain rig
CME-550, 20' long 8' wide, flotation tires,
- would not be able to use tower though which
is ~26' high which would make it slow
going

DVS = send us the info & all we can do is review
it & see who fits our needs

EA = John Kerscher called last week & said we have a 1-ton pickup
w/ rig but Eric doesn't think it will do the job
for us. Usually for 2.5" mil borings & has weak
transmission if push it too hard

1/5/99 Eric called & said not going to bid due to
too many unknowns & Union Labor rates make it risky
on a per foot basis

RECORD OF TELEPHONE CONVERSATION

DATE: 12/30/98 NAME: DVS

☒ INCOMING

☐ OUTGOING

NAME OF PERSON CALLING/CALLED: John Kueper

COMPANY/TITLE: Philip Services

PHONE NUMBER: 800 582-4410 ext 242

CLIENT: Schry 4 / Dayton

TIME IN:

TIME OUT:

DETAILS OF CONVERSATION: Bldg 40B Fairproduct drilling/MW installation

JK= Wants to know if they could get by using a
1 Ton Pickup Truck w/ rig mounted in back w/ 14' mast

DVS= give us the dimensions w/ bid & we'll look @ it

RECORD OF TELEPHONE CONVERSATION

DATE: 7/7/98 NAME: NVS ☐ INCOMING ☒ OUTGOING
NAME OF PERSON CALLING/CALLED: Jack Lindsay / Gary Ferro (Detroit Mr office)
COMPANY/TITLE: BFI
PHONE NUMBER: 248 347-9888
CLIENT: _____ TIME IN: _____ TIME OUT: 1440
DETAILS OF CONVERSATION: _____

Need cost estimate for soil disposal

Gary Ferro left message on his answer machine

Disposal \$23 / ton (need drum cost)
Transportation ? @ this time

Ford-Rouge Steel plant
2 Billion worth of renovation

He got involved because of Carlo (Rudy?) but we need to speak to the
Representative in Dayton Area = this guy would have trucks
& Big Foot Landfill contracts etc.
Gary will have him call us.

7/13/98 Karen Carpenter (Detroit)

Looking for Dayton OHIO Contact

Rudy Ondrus - 800 234 3429 ext 131 (Bill Guster)
313 729 3540

Toledo office - 800 234 3429 313 848 3633

Drew Cole?

Drew - in Toledo, Cleveland office would be better to handle

RECORD OF TELEPHONE CONVERSATION

DATE: 6/3/98 NAME: DVS

☒ INCOMING

☐ OUTGOING

NAME OF PERSON CALLING/CALLED: Jack Lindsay ext-3253 voice mail

COMPANY/TITLE: BFI

PHONE NUMBER: _____

CLIENT: 3-hwy 4 / dayton TIME IN: 15:15 TIME OUT: _____

DETAILS OF CONVERSATION: They will put the drilling soils in w/ the excavated soils

from Bldg 40B by Carlo Env. under the same
Carlo approval #

KDV- need a cost estimate for soil disposal from BFI

RFA-209

RECORD OF TELEPHONE CONVERSATION

DATE: 6/10/98 NAME: DVS

☒ INCOMING

☐ OUTGOING

NAME OF PERSON CALLING/CALLED: Susan Klenke

COMPANY/TITLE: Stoney-Hollow Landfill - Dayton

PHONE NUMBER: 937 267 5109

CLIENT: 3 chg + Dayton

TIME IN: 10:20

TIME OUT:

DETAILS OF CONVERSATION: Re Soil Disposal

I called her back 6/10

SK = if used solvents, how was it used on what type of materials
& need MSDS sheets then would start to pursue ~~the~~
seeing what we need to do for analytical.

DVS = We are ~~looking~~ @ Big Foot Landfill since they have accepted
soils from this same site & are familiar w/ what needed

SK = will call if that doesn't pan out.

RECORD OF TELEPHONE CONVERSATION

DATE:

6/1/92

NAME:

DVS



INCOMING



OUTGOING

NAME OF PERSON CALLING/CALLED:

COMPANY/TITLE:

BFI = Waste Management as of Feb 1st

PHONE NUMBER:

937-236-6868

CLIENT:

3 chry4/dayton

TIME IN: 15:15

TIME OUT:

DETAILS OF CONVERSATION:

Re: Soil Disposal

1) Need their list of Waste Characterization compounds sent to us

~~BFI~~

Susan Klenke: 267-5109

Stony Hollow Landfill

She will check on what we need and get back to me. likely tomorrow

6:40

Mike Randazzo - Carlo Env.

Chertee ^{Landfill} Not Chrysler approved

BFI = BFI

Stony Hollow Landfill - concerned w/ chemicals TCE PCE TCA

* Big Foot Landfill will accept soils

Morrow, OH local Sales Rep

Jack Lindsey Special Waste Coordinator

248 347-9888 ext FERRO

or Gary ^{Ferro} Same #

7:45

6/2

Gary Ferro not in gets beeped 7AM-6PM M-F left message

Jack Lindsey not in BFI ^{Hills} Arbor office

13:05 left message for Jack to call

Jack: Metals TCEP will likely need to be run, he will fax Profile Sheet

Mike Randazzo

800 236-6868

915 428 9200

RECORD OF TELEPHONE CONVERSATION

DATE:

6/3/98

NAME:

DUS



INCOMING



OUTGOING

NAME OF PERSON CALLING/CALLED:

Gary Ferro

COMPANY/TITLE:

BFI

PHONE NUMBER:

248 347-9888 ext Ferro Detroit

CLIENT:

3chry4/dayton

TIME IN: 8:55

TIME OUT:

DETAILS OF CONVERSATION:

Tell Jack or Gary

1) worst case scenario is Bldg 40B which just barely failed TCLP

2) Would like a roll-off & drum grapple to empty drums in roll-off

Then we would sample the bulk soils & wait for analysis

3) Soil metals analysis on dirtiest soil

Gary out Pager 810 870-1513

Jack Lindsey FAX = 248-347-9899

Maybe able

Direct buy it up by Detroit not sure of what they do in Dayton
V. expensive in Dayton because only 1 landfill

RECORD OF TELEPHONE CONVERSATION

DATE: 7/30/98 NAME: DVS

☐ INCOMING

☒ OUTGOING

NAME OF PERSON CALLING/CALLED: Randy Remy

COMPANY/TITLE: BFI

PHONE NUMBER: 513 771-4200

CLIENT: 3 chry 4 / Dayton

TIME IN: 8:07 TIME OUT:

DETAILS OF CONVERSATION:

(1) Does Joe have manifests?

left message to call me (2) Where is the soil going

(3) Have 120 drums not 80

Larry Michel (513 942-8600 (Philips)) Columbus Cincinnati

(1) Where is the stuff going?

(2) Needs manifest

(3) Have 120 drums not 80. LM = That would be 2 trips, truck can hold 80-88 drums

(4) 2 drums stay! Labelled TB-9 #10

Rdy got all paper work done but missed FedEx last night

for Manifests will go out FedEx today priority delivery tomorrow

Morrow Ohio 20-25^{miles} S. of Dayton (513) 899-3567 = landfill

DVS I called Joe Whitlock (937 224 7467)

left message FedEx package coming tomorrow

Larry = landfill hours = ? 6-4 pm Saturday 6-11 AM

Larry need drum loader HiLo

Joe Whitlock town 10:30 11 = official round

7 Roll-offs need to go also

Randy - need manifest & waste characterization paper 30 miles

Has to be BFI manifest

75 South to 275 East 1st exit = Mosteller turn left to stoplight

right there on corner 1156 Mosteller 30 miles S of Dayton

Larry = sending Kenny right out to load drums

(Casper 5986)
Need ETA for analytical

RECORD OF TELEPHONE CONVERSATION

DATE: 7/30/98 NAME: DRS ☒ INCOMING ☐ OUTGOING

NAME OF PERSON CALLING/CALLED: _____

COMPANY/TITLE: _____

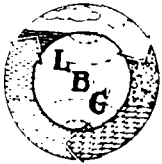
PHONE NUMBER: _____

CLIENT: Dayton TIME IN: _____ TIME OUT: _____

DETAILS OF CONVERSATION: _____

Joe needs ETA for analytical

7/30/98 Harry called & said the truck is @ the landfill but needs
to get towed up to disposal location & they don't
have any hooks on the truck so will have to
dump load tomorrow AM



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB 3CHRY / DAYTON
TIME 8:30 DATE 5/27/98
CONTACT NAME _____ DATE _____
FIRM _____
PHONE NO. _____

DISCUSSION

Moody's - Doug Wagner 937-859-4482

Perma-Fix - Carol 937-268-6501

All Waste Enviro. Services - (Hauling only) 937-~~268~~-233-8911
Rich - Said most landfills want to see a full TCLP

All drums - metals

ACTION

P H O N E M E M O	TO	DANE		DATE	5-28	TIME	10:35	AM/PM	PM
	FROM	Paul Seim		AREA CODE					
	OF	Perma-Fix		NO.	937-268-6501				
		Re: Contaminated Soil Drums		EXT.					
	MESSAGE	I called & left a message on 6/1/98 10:00 to return my call.							
	Fax # 937-268-9059				SIGNED				
	PHONED	CALL BACK	RETURNED CALL	WANTS TO SEE YOU	WILL CALL AGAIN	WAS IN	URGENT		

RECORD OF TELEPHONE CONVERSATION

DATE:

7/28/98

NAME:

DVS



INCOMING



OUTGOING

NAME OF PERSON CALLING/CALLED:

RAC

COMPANY/TITLE:

LBG

PHONE NUMBER:

St Paul

CLIENT:

3 chry 4/dayton

TIME IN: 12:30

TIME OUT:

DETAILS OF CONVERSATION:

Chrysler Plant bigwig
Nick Beck wants drums moved off property by Friday

BFI

Rudy Ranty

7/28/98 12:43

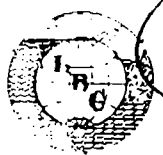
513 771-4200

- want prices today gone by Friday per KDV
- left message

14:45 - can't find any Union haulers in hold up

- he will check up back on
- loading & hauling \$14/hour but no Union

I talked to KDV, he will call Phillips to see if they can haul since they've hauled before & are currently set up as Union (limited show)



To KEN
LEGGETTE, BRASHEARS
& GRAHAM, INC.
 Professional Ground-Water Consultants

JOB Dayton Thermal
 SHEET NO. _____ OF _____
 CALCULATED BY _____ DATE 9/15/98
 CHECKED BY _____ DATE _____
 SCALE _____

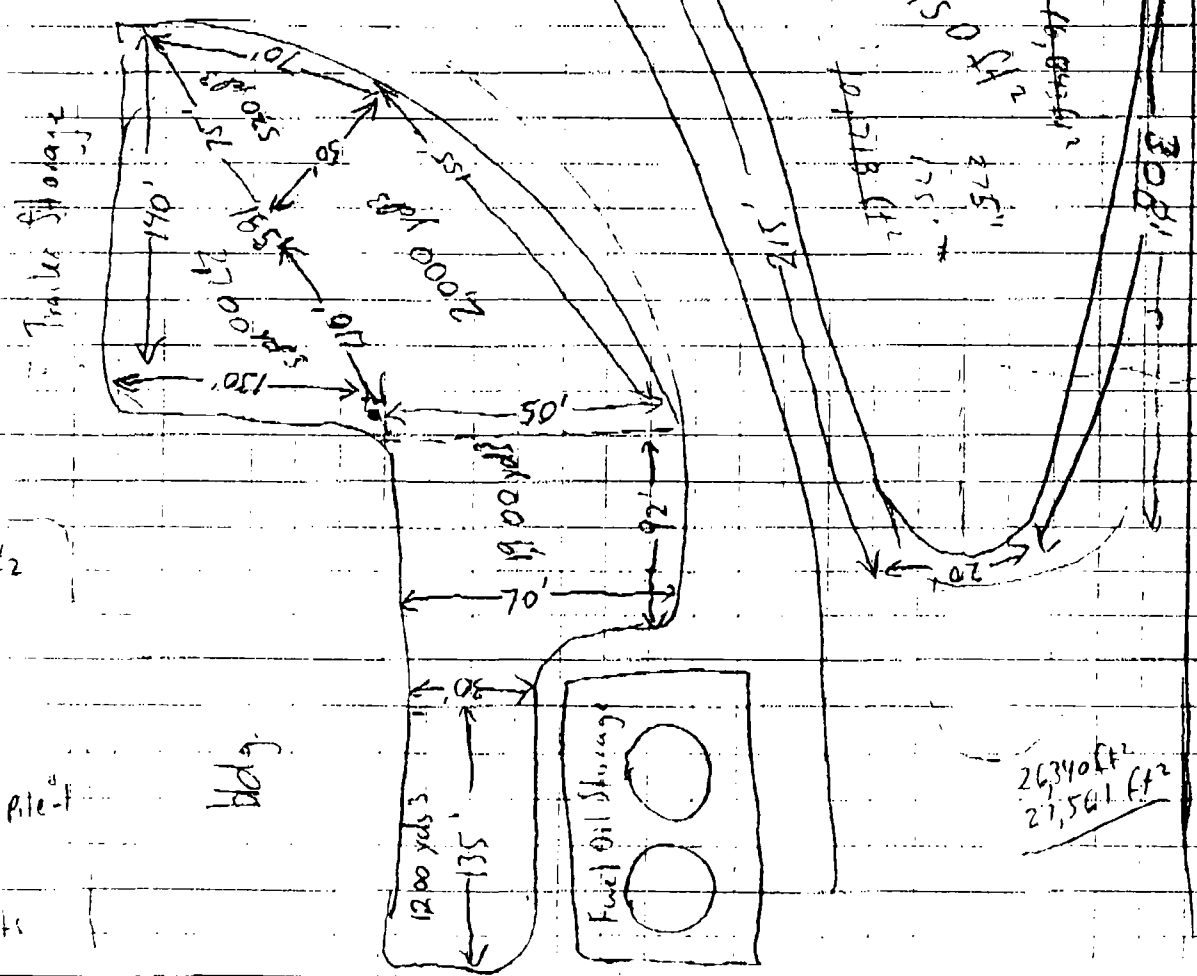
$$\begin{array}{r} 22,050 \text{ ft}^2 \\ + 26,950 \text{ ft}^2 \\ \hline 49,000 \text{ ft}^2 \times 8' = 392,000 \\ \hline 27,143 \end{array}$$

14,518 yds³
 File #2

M ↑

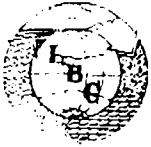
2000
 2,700
 520
 1,200
 1,200
 8,320

14,500 yds³
 3,500 yds³
 1000 yds³
 Soil Pile #1
 8,500 yds³



= Pile #2
 9' x 12'

18' = Pile #1
 16'
 Heights



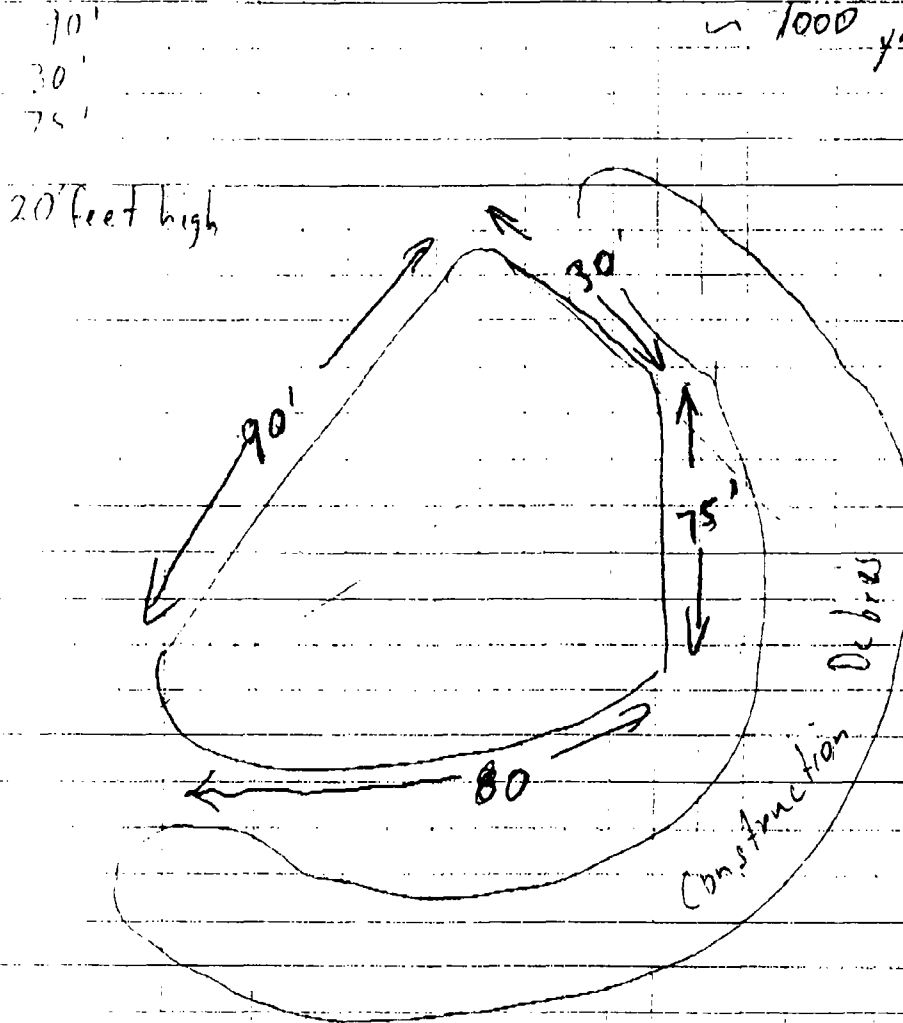
**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

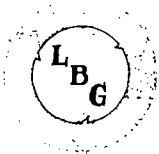
JOB Dayton Thermal
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE 9/15/98
CHECKED BY _____ DATE _____
SCALE _____

Pile # 3

1000 yds

↑ N





**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB 3CHRY 4/DAYTON
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY John Mathes DATE CleanTech
SCALE _____

"Clean" soil stockpile =	<u>9/4/91</u> 14,050 yds ³	<u>4/93</u> 7,180 15
{ VOC pile =	6,070 yds ³	10,800 15
{ TPH pile =	13,600 yds ³	2,800 18
	<u>33,720 yds³</u>	<u>20,700 yds³</u>
	x	fluff factor
		+ 1,800
	<u>19,670</u>	22,500 yds ³
	VS.	<u>15,400</u>

Cell phone

$$150,000 = 1 \text{ discrete sample} / 10,000 \text{ yds}^3$$



sample for geotechnical (engineered base)

for every 3 of above,



one TCLP sample (composite)

2 composite

Pile 2 - North of tracks, 14,500 yds³ (≈ 300' x 200' x 8')
 trees up to 5-15' definitely construction debris
 cobbles 2"-6" (sufficient)

1 composite

Pile 1 - aggregate covered, south of tracks by fuel storage 8,500 yds³

1 composite

Pile 3 - all construction debris ≈ 1,000 yds³

Tim Kruger
 Diane Ellmore + Cathy Tavel x.4610

Joe Whitlock →

- weekend electricity protocols?

- timing of Schmidt Hole
- 4th Qtr. cost projections

Pat Steck - no answer

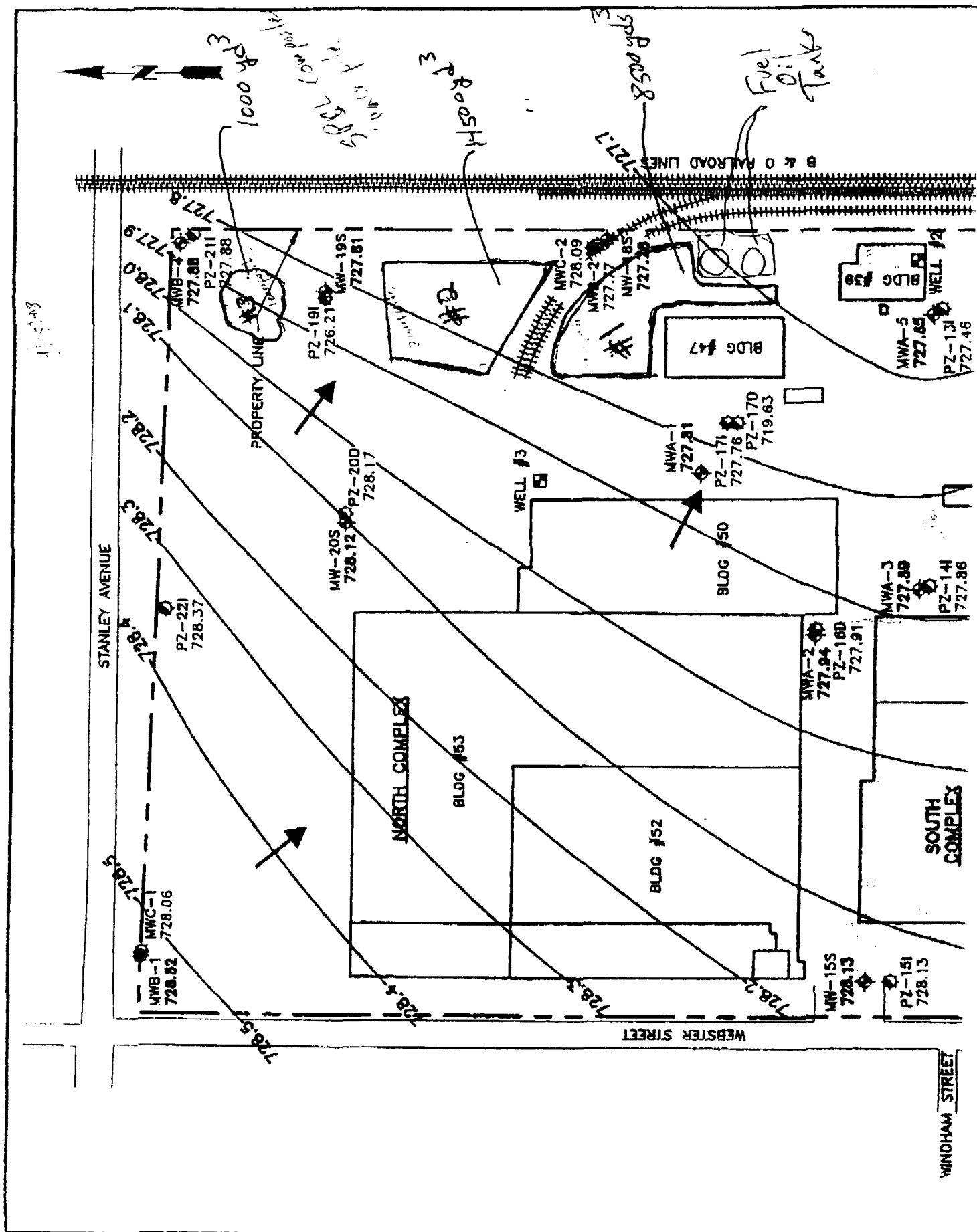
↓ ton ≠ rail

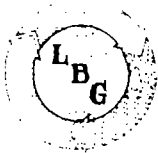
8700 yds > \$30/yd.

- Joe Whitlock no volume!
 no access!

flow rate - down in steam tunnel

888 - 572 - 5736 pager





**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB 30NR44 / Dayton
TIME 8:35 DATE 6-25-99
CONTACT NAME Spencer
FIRM ~~Leggette, Brashears & Graham~~ Waste Management
PHONE NO. 937-267-5105

DISCUSSION

Spencer called to provide info. on sampling protocol - numbers of samples to be collected, for the stockpiled on site. Spencer stated that there are no established guidelines that must be followed. What they do need is a representative sample. They like to see 1 sample / 2,500 yds².

This means we would need to collect
9.6 or 10 samples for
the 24,000 yds² on site.

ACTION



JOB 3014/200

TIME 3:00

DATE 6-6-20

CONTACT NAME

FIRM

PHONE NO

DISCUSSION

Refer for information on disposal of soil (or disposal purposes) (see below) (see below)

* Under Chapter 7037 et of rules.

CHIRAL Molecules 3

Algebra 1 Unit 3: Quadratics

3.2 - 3.11

01/01/2011

2 d 21.32.41. 2110-110

20

7-70123

$$2,001 - 4 \text{ m yd}^3$$

cap: Bulbifera 2.00 μm^3

24.7.1953

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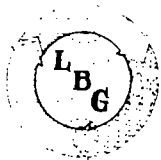
As -

- $\frac{d}{dt} \left(\frac{1}{r^2} \right) = -\frac{2}{r^3} \frac{dr}{dt}$
- $\frac{d}{dt} \left(\frac{1}{r^2} \right) = -\frac{2}{r^3} \frac{dr}{dt}$
- $\frac{d}{dt} \left(\frac{1}{r^2} \right) = -\frac{2}{r^3} \frac{dr}{dt}$

ACTION

Chadwick Nelson,

3/1/02 1000 " " 1000 P 100, 7007.2900 Ship 1 +
" " " " " 0700 Ship 2.



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB 301814 / LK1101
TIME 1:40 PM DATE 6-7-69
CONTACT NAME ELSON L. M. ROBERTS
FIRM NO. 1000015 WASTE DEPT., MI
PHONE NO. 937-285-6035

DISCUSSION

To determine the number of soil samples to take. 11/1/69
SW-246 (held 2 samples) have 200 yds. 70%
* look more sampling points.

ACTION

**ENVIRONMENTAL RESPONSE DIVISION**

*Method 5035 is binder
SW-846 → EPA*

2.0 Acceptable Methods

2.1) Question: *Are private parties and consultants required to use MDEQ's method of soil sampling and lab analysis?*

Answer: Organizations, labs and consultants are free to use any protocols that are consistent with Method 5035. They only need document their procedures so that data adequacy and accuracy can be demonstrated.

2.2) Question: *Method 5035 lists use of EnCore Samplers™. Will MDEQ accept use of these samplers rather than methanol preservation?*

Answer: Yes, use of the EnCore Sampler™ in accordance with Method 5035 is an acceptable alternative to methanol preservation of samples.

2.3) Question: *Method 5035 lists a low-level method of soil sampling/preservation using sodium bisulfate. Why did MDEQ not choose to use this method of sample preservation?*

Answer: First, the method does not work in all soil types. In calcareous soils, sodium bisulfate has a chemical reaction with the soil and adversely affects the analysis. Secondly, the low-level method requires the purchase of special equipment to run the method correctly. Additionally, with the low-level method, soil samples need to be weighed to within +/- 0.1 gram in the field and this is extremely difficult to do under field conditions. The MDEQ will however, accept results obtained using this methodology if performed correctly.

Lastly, the MDEQ lab was able to achieve target detection limits (DLs) below the most restrictive regulatory criteria using methanol preservation for all contaminants of concern except vinyl chloride.

2.4) Question: *In circumstances where the Target Detection Limit (TDL) is higher than regulatory criteria for a certain constituent, will the MDEQ accept "Non-detect" as satisfying the regulatory requirements?*

Answer: Yes. The TDL would be the default criteria until better lab techniques reduce the TDL to below the most restrictive criteria. In the cleanup program this only applies to one constituent – vinyl chloride.

2.5) Question: *Will Michigan require the low-level sodium bisulfate preservation sampling and analysis method?*

Answer: MDEQ does not anticipate recommending use of the low-level method until the method or the lab equipment is perfected for routine production analysis. MDEQ will, however, accept results obtained from use of low-level method if performed properly.

2.6) Question: *How will this affect use of field GC methodology? Can we continue to use it? If we use both, does staff need guidelines addressing when to use which method?*

Answer: Method 5035 should be used to generate data to demonstrate compliance with regulatory programs.

Other methods may be used for field screening purposes to get a general idea of the scope of a problem. However, the results should be cautiously interpreted. See the response to "Question 1" in the section entitled "General."

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[Next](#)

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Environmental Response Division



[Home Page](#)

Revised October 14, 1998 Fred O. Moyer

The Webmaster is not responsible for the content.

<http://www.deq.state.mi.us/erd/>

JOB 30254 / 101701

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

Number of total $Y_{\text{total}} = 10$

$$n = \frac{t^2 \cdot 0.20 \cdot 5^2}{A^2}$$

$$\Delta = RT - \bar{y}$$

$\{T = \frac{\pi}{\sqrt{g}}$

Metals

• ARYANIC

$$n = \frac{(1.886j)^2 (0.76)}{6.90 - 7.5} = -4.5 = 4.5$$

VOC5

- Trichloroethylene

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n} = \frac{(5+1+10)}{3} = 5.3$$

$$s^2 = \frac{\sum_{i=1}^n x_i^2}{n-1} - \frac{\left(\frac{\sum_{i=1}^n x_i}{n}\right)^2}{1} = \frac{126}{2} - \frac{(85.3)^2}{1} = 20.35$$

$$n = \frac{(1.886)^2 (20.35)}{77,000 - 5.3} = \frac{72.38}{76994.7} = .001$$

- TetraChloroethylene

$$\bar{x} = \frac{(1 + 12 + 1)}{3} = 4.6$$

$$s^2 = \frac{(1^2 + 12^2 + 1^2)}{3} - \frac{(1 + 12 + 1)^2}{9} = \frac{146 - 65.3}{3} = 40.33$$

$$h = \frac{(1.386)^2 (40.35)}{94.00 - 4.6} = \frac{143.52}{9395.4} = .0015$$



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

SVOCs

- Benzo (a) Anthracene

$$\bar{Y} = \frac{300 + 58 + 110}{3} = 156$$

$$S^2 = \frac{(300^2 + 58^2 + 110^2) - \frac{(300 + 58 + 110)^2}{3}}{2} = \frac{105464 - 73008}{2}$$

$$n = \frac{(1.886)^2 (16228)}{5500 - 156} = \frac{57723}{5344} = 10.8$$

- Benzo (b) Fluoranthene

$$\bar{Y} = \frac{380 + 76 + 110}{3} = 188.6$$

$$S^2 = \frac{(380^2 + 76^2 + 110^2) - \frac{(380 + 76 + 110)^2}{3}}{2} = \frac{162276 - 106785}{2}$$

$$n = \frac{(1.886)^2 (27745.5)}{5500 - 188.6} = \frac{98190.6}{5311.4} = 18.5$$

- Fluoranthrene

$$\bar{Y} = \frac{610 + 100 + 250}{3} = 320$$

$$S^2 = \frac{(610^2 + 100^2 + 250^2) - \frac{(610 + 100 + 250)^2}{3}}{2} = \frac{446000 - 307200}{2} = 68700$$

$$n = \frac{(1.886)^2 (68700)}{1,300,000 - 320} = \frac{244365.6}{1299680} = 0.18$$



**LEGGETTE, BRASHEARS
& GRAHAM, INC.**
Professional Ground-Water Consultants

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

• Pyrene

$$\bar{X} = \frac{420 + 70 + 180}{3} = 223$$

$$S^2 = \frac{(420^2 + 70^2 + 180^2) - \frac{(420 + 70 + 180)^2}{3}}{2} = \frac{213700 - 149633}{2} = 32033.5$$

$$n = \frac{(1.886)^2 (32033.5)}{950,000 - 223} = \frac{113943}{949777} = 0.12$$

TABLE 2

DAYTON THERMAL PRODUCTS
DAYTON, OHIO

SOIL PILE #1 (SOUTHERNMOST)

SUMMARY OF POSITIVE DETECTIONS IN SOIL
SEMI-VOLATILE ORGANIC COMPOUNDS
CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	SAMPLE DATE	DILUTION FACTOR	ANTHRACENE	BENZO (a) ANTHRACENE	BENZO (b) FLUORANTHENE	BENZO (k) FLUORANTHENE	BENZO (g,h,i) PERYLENE	BENZO (a) PYRENE	CARBAZOLE	CHRYSENE	INDENO (1,2,3-cd) PYRENE	FLUORANTHENE	PHENANTHRENE	PYRENE
VAP RESIDENTIAL LIMITS	ug/kg			9,500,000	5,500	5,500	55,000	—	550	—	550,000	5,500	1,300,000	—	950,000
VAP INDUSTRIAL LIMITS	ug/kg			89,000,000	31,000	31,000	310,000	—	3,100	—	3,100,000	31,000	12,000,000	—	8,900,000
SP-1 - SB-1	4-6'	09/15/1998	1.0	75 J	300 J	380	130 J	140 J	250 J	53 J	290 J	140 J	610	370 J	420
SP-1 - SB-2	4-5'	09/15/1998	1.0	<380	58 J	76 J	<380	<380	54 J	<380	62 J	<380	100 J	54 J	70 J
SP-1 - SB-3	4-5'	09/15/1998	1.0	<380	110 J	110 J	76 J	46 J	71 J	<380	110 J	47 J	250 J	150 J	180 J

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS *GENERIC DIRECT-CONTACT SOIL STANDARDS* 1998 1st ADDITION

—: NOT ESTABLISHED

J: ESTIMATED VALUE

<: LESS THAN

SP-1: SOIL PILE 1

SB-1: SOIL BORING 1

TABLE 5

DAYTON THERMAL PRODUCTS
DAYTON, OHIO

SOIL PILE #1 (SOUTHERNMOST)

RCRA METALS

UNITS ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
VAP RESIDENTIAL LIMITS mg/kg			6.90	5,000.00	32.00	230.00	—	16.00	—	—
VAP INDUSTRIAL LIMITS mg/kg			86.00	140,000.00	300.00	2,800.00	—	230.00	—	—
SP-1 - SB-1	4-6'	09/15/1998	6.9	53.7	0.73	12.9 E	26.4 E	<0.06 N	0.67 N	<0.07
SP-1 - SB-2	4-5'	09/15/1998	8.5	51.1	1.7	15.3 E	17.9 E	<0.06 N	<0.57 N	<0.07
SP-1 - SB-3	4-5'	09/15/1998	7.1	50.5	1.0	10.7 E	17.7 E	1.8 N	<0.56 N	<0.06

RCRA: RESOURCE CONSERVATION AND RECOVERY ACT

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS "GENERIC DIRECT-CONTACT SOIL STANDARDS" 1998 1st ADDITION

—: NOT ESTABLISHED

B: ANALYTE WAS FOUND IN THE ASSOCIATED BLANK AS WELL AS THE SAMPLE.

E: ESTIMATED VALUE (SEE REPORT QUALIFIERS)

J: ESTIMATED VALUE

N: SAMPLE SPIKE RECOVERY IS OUTSIDE OF CONTROL LIMITS

<: LESS THAN

SB-1: SOIL BORING 1

SP-1: SOIL PILE 1

CHROMIUM LIMITS BASED ON CHROMIUM VI: CHROMIUM III RESIDENTIAL = 8,800 mg/kg; INDUSTRIAL = 63,000 mg/kg

TABLE 1

DAYTON THERMAL PRODUCTS
DAYTON, OHIO

SOIL PILE #1 (SOUTHERNMOST)

SUMMARY OF POSITIVE DETECTIONS IN SOIL
VOLATILE ORGANIC COMPOUNDS

UNITS ARE IN MICROGRAMS PER KILOGRAM (ug/kg)

SAMPLE LOCATION	SAMPLE DEPTH (FEET)	DATE	DILUTION FACTOR	1,1-DICHLORO- ETHANE	1,2-DICHLORO- ETHENE (TOTAL)	TRICHLORO- ETHENE	TETRACHLORO- ETHENE	ACETONE	METHYLENE CHLORIDE	DIESEL RANGE ORGANICS	TOTAL PETROLEUM HYDROCARBONS
VAP RESIDENTIAL LIMITS ug/kg				620,000	—	77,000	94,000	4,500,000	220,000	—	—
VAP INDUSTRIAL LIMITS ug/kg				2,300,000	—	330,000	370,000	55,000,000	990,000	—	—
SP-1 - SB-1	4-6'	09/15/1998	1.0	<11	<23	5 J	1 J	3 JB	8 JB	<57,000	108,000
SP-1 - SB-2	4-5'	09/15/1998	1.0	<12	4 J	1 J	<12	2 JB	9 JB	<58,000	93,200
SP-1 - SB-3	4-5'	09/15/1998	1.0	1 J	3 J	10 J	1 J	4 JB	9 JB	<58,000	325,000
SP-1 - CP-1	COMPOSITE	09/15/1998	—	—	—	—	—	—	—	—	120,000
T-0001	—	09/15/1998	1.0	<10	<20	<10	<10	2 JB	10 B	—	—

VAP: OHIO EPA VOLUNTARY ACTION PROGRAM REGULATIONS *GENERIC DIRECT-CONTACT SOIL STANDARDS* 1998 1st ADDITION

—: NOT ESTABLISHED OR NOT ANALYZED

B: ANALYTE WAS FOUND IN THE ASSOCIATED BLANK AS WELL AS THE SAMPLE.

J: ESTIMATED VALUE

<: LESS THAN

SP-1: SOIL PILE 1

SB-1: SOIL BORING 1

CP-1: COMPOSITE SAMPLE OF SB-1, SB-2, AND SB-3

T-0001: TRIP BLANK

LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUND-WATER AND ENVIRONMENTAL ENGINEERING SERVICES

NORTH PARK CORPORATE CENTER
1210 WEST COUNTY ROAD E
SUITE 700
ST. PAUL, MN 55112
612-490-1405
FAX 612-490-1006

October 24, 1997

Mr. Marvin L. Neargarder, Plant Engineer
Chrysler Corporation
Dayton Thermal Products
CIMS 478-05-00
1600 Webster Street
Dayton, Ohio 45404-1205

Re: Hazardous Soil Excavation Contractors
Building 40B Construction
Dayton Thermal Products
Dayton, Ohio

Dear Mr. Neargarder:

In response to our recent discussions regarding the referenced project, the following union excavation contractors have previously provided favorable services on numerous Chrysler environmental projects managed by Leggette, Brashears & Graham, Inc. (LBG) and/or other Chrysler Remediation Partners. These contractors warrant consideration for possible inclusion on the bid list for anticipated hazardous soil excavation and associated work activities at the subject site.

Mr. Mike Lock
Sevenson Environmental Services, Inc.
9245 Calumet Avenue, Suite 101
Munster, Indiana 46321
(800) 779-7703

Mr. Jeff Barsin
K&D Industrial Services, Inc.
30105 Beverly Road
Romulus, Michigan 48714
(313) 722-8922

Mr. Marshall Bates
Alpha-Omega
500 Lee Road, Suite 215
Cleveland, Ohio 44128
(216) 475-7744

Mr. Thom Kubeshesky
Carlo Environmental
44907 Trinity Drive
Clinton Township, Michigan
(810) 468-9580

Mr. Jim Leonard
Aqua-Tech
12400 Universal Drive
Taylor, Michigan 48180
(313) 946-4464

Mr. Paul Pryzgocki
Philip Environmental Services, Inc.
515 Lycaste
Detroit, Michigan
(313) 824-6350

RAMSEY, NEW JERSEY

TRUMBULL, CONNECTICUT

TAMPA, FLORIDA

SIoux FALLS, SOUTH DAKOTA

WEST CHESTER, PENNSYLVANIA

CHELMSFORD, MASSACHUSETTS

WHITE PLAINS, NEW YORK

AUSTIN, TEXAS

MADISON, WISCONSIN

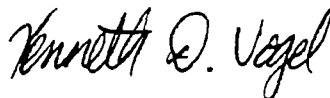
HOUSTON, TEXAS

At your convenience, please provide me with a construction schedule, anticipated excavation contractor contracting arrangement (direct with Chrysler or through LBG), waste hauling/disposal responsibility (Chrysler or LBG), and any plant-required union labor guidelines/requirements (so our specifications accurately reflect necessary union provisions). In addition, please let us know the specific geotechnical sampling and analytical requirements for the footings areas.

In the mean time, please contact me at (612) 490-1405 should you have comments/questions, or require additional information. We at LBG look forward to working with you and your staff on this project.

Sincerely,

LEGGETTE, BRASHEARS & GRAHAM, INC.

A handwritten signature in black ink, reading "Kenneth D. Vogel". The signature is written in a cursive, flowing style.

Kenneth D. Vogel, PG, CHMM
Associate

KDV:kw

cc: Mr. Gary Stanczuk, Chrysler
S:\TECH3\CHRY\DAYTON\FINALDOC\HAZCON.LTR

TASK PRICING WORKSHEET

CHRYSLER CORPORATION
DAYTON THERMAL PRODUCTS

September 10, 1998

PROPOSAL NUMBER 3CHRY4-10

COST ESTIMATE SUMMARY - Stockpiled Soil Loading and Transport

TASK	TASK NAME	LBG Labor Cost	LBG Expenses	Other Charges	Grand Total Fee and Expenses
Task 1	Project Coordination and Contracting	\$7,152	\$1,352	\$107	\$8,611
Task 2	Soil Sampling/Free Product Sampling	\$6,552	\$6,185	\$177	\$12,913
Task 3	Stockpiled Soil Loading and Transport	\$13,323	\$648,867	\$200	\$662,391
TOTALS		\$27,027	\$656,404	\$484	\$683,915

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TASK PRICING WORKSHEET
CHRYSLER CORPORATION
DAYTON THERMAL PRODUCTS

September 10, 1998

Task 1: Project Coordination and Contracting

Work Description: This task includes LBG services for scheduling, bidding, costing, contracting, and coordinating the loading and transport of approximately 20,000 to 40,000 cubic yards of stockpiled soils from Dayton, OH to Stickney Avenue site in Toledo, OH. Chrysler has requested that shipments begin on or about September 25, 1998 with a minimum of 5,000 tons of soil per day being transported.

PROFESSIONAL FEES

Staff Level	Description of Responsibilities	Direct Labor Rate	Estimated Hours	Labor Cost	
Principal	Contract Review	\$42 /hr.	2	\$249	
Assoc.	Project coordination, bidding, contracting	\$32 /hr.	40	\$3,802	
Sr. Hydro.		\$27 /hr.		\$	
Sr. Eng.		\$28 /hr.		\$	
Hydro.		Communications, bidding	\$21 /hr.	40	\$2,495
Eng.			\$21 /hr.		\$
Tech.	\$17 /hr.			\$	
Draft.	Bid figures	\$19 /hr.	6	\$339	
Admin.	Bid Documents, correspondence	\$15 /hr.	6	\$267	
			TOTAL	\$7,152	

REIMBURSED EXPENSES

Expense Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Plots	Site figures and drawings, specifications	\$1.5 /ea.	15	1.000	\$23
Meals	One personnel	\$35 /day	2	1.000	\$70
Rental Car	Rental car	\$50 /day	2	1.000	\$100
Hotel	Hotel	\$65 /day	1	1.000	\$65
Airfare	Travel to Dayton for bid meeting	\$1,000 /ea.	1	1.000	\$1,000
Fed Ex	document transmittal	\$15 /ea.	6	1.050	\$95
					\$0
					\$0
					\$0
Reimbursed Expense Total					\$1,352

OTHER CHARGES

Service Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Office Supplies	Office phone, fax, copies, postage, diskette (1.5 percent of professional fees total)	\$107	1	1.000	\$107
					\$0
					\$0
					\$0
					\$0
Other Charges Total					\$107

TASK PRICING WORKSHEET

CHRYSLER CORPORATION
DAYTON THERMAL PRODUCTS

September 10, 1998

Task 2: Soil Sampling/Free Product Sampling

**Work
Description:**

This task includes LBG services to conduct hand auger soil sampling of stockpiled soils and to conduct field measurements of the size of the soil stockpiles. The samples will be analyzed by CompuChem per the analytical requirements of the Stickney Avenue site. In addition, free product sampling in Building 40B will be completed. Lancaster Labs will conduct analyses of up to 4 samples for free product characterization, solvent identification, PCBs, and TPH.

PROFESSIONAL FEES

Staff Level	Description of Responsibilities	Direct Labor Rate	Estimated Hours	Labor Cost
Principal	Project planning and communication	\$42 /hr.		\$
Assoc.		\$32 /hr.	8	\$760
Sr. Hydro.		\$27 /hr.	40	\$3,208
Sr. Eng.	Soil Sampling	\$28 /hr.		\$
Hydro.		\$21 /hr.	40	\$2,495
Eng.		\$21 /hr.		\$
Tech.		\$17 /hr.		\$
Draft.	Travel arrangements	\$19 /hr.		\$
Admin.		\$15 /hr.	2	\$89
TOTAL			\$6,552	

REIMBURSED EXPENSES

Expense Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Equipment	Soil Sampling equip.	\$150. /ea.	1	1.000	\$150
PID	Soil screening photoionization detector	\$85 /day	2	1.000	\$170
Bailers	free product sampling	\$10 /ea.	4	1.050	\$42
Meals	Two personnel	\$35 /day	6	1.000	\$210
Rental Car	Rental car	\$50 /day	2	1.000	\$100
Hotel	Hotel	\$65 /day	2	1.000	\$130
Lab Analytical	Free Product Analyses	\$3,000	1	1.075	\$3,225
Airfare	Two personnel	\$1,000 /ea.	2	1.000	\$2,000
Misc. Supplies	ice, rope, baggies, PPE, etc.	\$150	1	1.050	\$158
Reimbursed Expense Total					\$6,185

OTHER CHARGES

Service Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Office Supplies	Office phone, fax, copies, postage, diskettes	\$98	1	1.000	\$98
	(1.5 percent of professional fees total)				\$0
FEDEX	Sample shipment	\$75 /ea.	1	1.050	\$79
					\$0
Other Charges Total					\$177

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ESTIMATED TASK TOTAL \$12,913

TASK PRICING WORKSHEET

CHRYSLER CORPORATION
DAYTON THERMAL PRODUCTS

September 10, 1998

Task 3: Stockpiled Soil Loading and Transport

Work
Description:

This task includes LBG services preparing for construction activities and scheduling

PROFESSIONAL FEES

Staff Level	Description of Responsibilities	Direct Labor Rate	Estimated Hours	Labor Cost
Principal	Project coordination, communication	\$42 /hr.	8	\$
Assoc.		\$32 /hr.		\$760
Sr. Hydro.		\$27 /hr.		\$
Sr. Eng.	Supervision and documentation of soil loading	\$28 /hr.	200	\$
Hydro.		\$21 /hr.		\$12,474
Eng.		\$21 /hr.		\$
Tech.		\$17 /hr.		\$
Draft.	Communication	\$19 /hr.	2	\$
Admin.		\$15 /hr.		\$89
TOTAL				\$13,323

2.97

REIMBURSED EXPENSES

Expense Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Fed Ex	Document Transmittal	\$15. /ea.	3	1.050	\$47
PID	Soil screening photoionization detector	\$255 /wk	2	1.000	\$510
Meals	One personnel	\$35 /day	14	1.000	\$490
Rental Car	Rental car	\$50 /day	14	1.000	\$700
Hotel	Hotel	\$65 /day	14	1.000	\$910
Airfare	One personnel	\$1,000 /ea.	1	1.000	\$1,000
Contractor	Soil loading and transport	\$10 /ton	60,000	1.075	\$645,000
Field phone	Field communications	\$100 /wk	2	1.050	\$210
					\$0
					\$0
					\$0
Reimbursed Expense Total					\$648,867

OTHER CHARGES

Service Item	Description	Unit Rate	Number of Units	Markup	Total Cost
Office Supplies	Office phone, fax, copies, postage, diskettes (1.5 percent of professional fees total)	\$200	1	1.000	\$200
					\$0
					\$0
					\$0
					\$0
					\$0
					\$0
					\$0
Other Charges Total					\$200

**LEGGETTE, BRASHEARS
& GRAHAM, INC.**

Northpark Corporate Center
1210 West County Road E
Suite 700
St. Paul, MN 55112
651-490-1405
651-490-1006 (FAX)

LETTER OF TRANSMITTAL

DATE:	19-Jul-99	JOB NO.:	3CHRY4/DAYTON
ATTN:	Mr. Mike Webb		
RE:	Stockpile Test Pits/Soil Sampling		
	Dayton Thermal Products		
	Dayton, OH		

TO: Onyx Industrial Services, Inc.
6151 Executive Blvd.
Huber Heights, OH 45424
(937) 237-1097, fax: 1850

WE ARE SENDING YOU: ☐ Attached ☐ Under separate cover via _____ the following items:
☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	07/19/99		Standard Form Contract which includes the Scope of Services and request for cost estimate in Exhibit B.

THESE ARE TRANSMITTED as checked below:

- | | | |
|--|---|---|
| <input type="checkbox"/> For approval | <input type="checkbox"/> Approved as submitted | <input type="checkbox"/> Resubmit _____ copies for approval |
| <input type="checkbox"/> For your use | <input type="checkbox"/> Approved as noted | <input type="checkbox"/> Resubmit _____ copies for distribution |
| <input type="checkbox"/> As requested | <input type="checkbox"/> Returned for corrections | <input type="checkbox"/> Return _____ corrected prints |
| <input type="checkbox"/> For review and comment | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> FOR BIDS DUE ___ 19 ___ | <input type="checkbox"/> PRINTS RETURNED AFTER LOAN TO US | |

REMARKS: _____

Please review the enclosed documents and provide us with a cost estimate accordingly.

Please sign and return two copies of the Standard Form Contract signature page and Exhibit B with your bid.

Upon approval, LBG will sign both copies and return one for your files.

COPY TO: file

SIGNED: David V. Strand

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David V. Strand
Hydrogeologist II

**LEGGETTE, BRASHEARS & GRAHAM, INC.
STANDARD FORM CONTRACT**

**DAIMLERCHRYSLER CORPORATION
DAYTON THERMAL PRODUCTS
DAYTON, OHIO
SOIL SAMPLING OF STOCKPILED SOILS**

AGREEMENT

This Agreement is made this 20th day of July, 1999 by LEGGETTE, BRASHEARS & GRAHAM, INC., 1210 West County Road E, Suite 700, St. Paul, Minnesota 55112 (hereinafter referred to as "LBG") and Onyx Industrial Services, Inc. with offices at 6151 Executive Blvd., Huber Heights, Ohio 45424 (hereinafter referred to as Contractor).

In reliance on the representations and undertakings herein, LBG engages Contractor as an independent contractor, and not as an employee, partner or joint venturer.

DEFINITIONS

The following words, when capitalized, shall have the following meaning:

"Client" shall mean LBG's Client, i.e. DaimlerChrysler Corporation (hereinafter called Client or Owner), as identified in Exhibit "A".

"Deliverables" shall mean all final reports and designs rendered by LBG and all systems or equipment installed by LBG or under its supervision.

"Insurance" shall mean the Insurance coverage requirements set forth in Exhibit "C".

"LBG" shall mean Leggette, Brashears & Graham, Inc., its principals, officers, directors, employees and any subsidiary or affiliated organization.

"Project" shall mean the Client project, contract and related documents identified in Exhibits "A", "B" and "C".

"Contractor's Scope of Services" or "Services" shall mean those Services to be performed by Contractor under this Agreement, as identified in Exhibit "B", and any modification thereto made under paragraphs 1.2 or 1.3.

"Trade Secret, Proprietary or Privileged Information" shall mean any information, design,

process, procedure, formula, improvement or business information that is commercially valuable to LBG or Client, or that is identified or treated as proprietary, privileged or confidential by LBG or Client, including the terms of this Agreement.

"Work Product" shall mean Deliverables, all scientific and technical data, reports, notes, field data, diagrams, laboratory test results and all other records or materials generated or used in connection with the Services performed under this Agreement, whether generated or provided by LBG, Client or Contractor.

SERVICES

1.1 Commencement: Contractor shall perform Services and will submit progress billing and reports as required. Contractor agrees to perform Services in a professional and workmanlike manner under LBG's supervision, commencing as early as July 1999 and proceeding continuously as required by the Project until Services are completed.

1.2 LBG Revisions: LBG may issue written work order changes which call for services in addition to those contemplated in Exhibit "B", so long as the additional work is the same kind of service described in the Scope of Services. Unless otherwise agreed in writing, compensation for such work order changes will be made at the prices and rates set forth in Exhibit "B", and pursuant to the terms of this agreement.

1.3 Contractor Revisions: If Contractor anticipates that Services cannot be performed in the manner or time frame required by this agreement, Contractor shall immediately inform LBG by written notice and shall submit proposed revisions to the Services that reflect Contractor's best estimates of what can realistically be achieved. Contractor will continue to work under the original timetable and milestones until otherwise directed by LBG. Contractor shall prepare and submit reports of its performance and its progress as LBG may reasonably request from time to time.

1.4 Worker Health and Safety: Contractor shall be solely responsible for the health and safety of its employees, agents and subcontractors. Contractor shall be responsible for initiating, maintaining and supervising health and safety precautions prepared specifically for the Project, if any, and for complying with Federal, State or local health and safety requirements. Contractor shall provide any training and equipment required by the foregoing and as may otherwise be necessary to prevent injury to its employees, agents, subcontractors, the general public or others in connection with work to be performed hereunder. Contractor shall not perform services in the absence of LBG's designated project supervisor without written notice to, and approval from, LBG.

COMPENSATION

2.0 General: LBG shall pay Contractor the unit rates, fees, and expenses shown in Exhibit "B" for Services performed. Unit rates, fees, and expenses not shown in Exhibit "B" will not be paid unless agreed to by LBG in writing before such fees and expenses are incurred.

2.1 Statements: Contractor shall submit statements for Services performed to LBG monthly or at such other interval as LBG may reasonably require. Along with such detailed time and expense logs and such other backup and supporting documentation as LBG may reasonably require. LBG shall have 15 days after receiving Contractor's statement to notify Contractor of an exception or question. If no such notice is made, the statement will be deemed accepted subject to Client's approval. LBG shall bill Client for the Services performed by Contractor in accordance with the requirements of this Project.

2.2 Payment: LBG shall pay amounts due to Contractor within 30 days after LBG receives payment from Client for the Services performed by Contractor, or within 60 days of the date of LBG's acceptance of Contractor's invoice, whichever occurs first. If Client remits payments which, in the aggregate, are less than the full amount due to LBG, each such payment shall be distributed pro rata among LBG, Contractor, and any other contractors whose Services were billed in support of such payment, based upon the amount that each of them is owed as of the date of such payment.

TERM

3.0 General: This Agreement shall, unless modified in writing signed by the parties or unless terminated as

provided herein, continue until the earlier of: (1) the satisfactory completion of the Services; or, (2) termination of the agreement between LBG and Client. Notwithstanding the foregoing, the provisions of paragraphs 2.0, 2.1, 2.2, 4.0, 4.1, 4.2 and 5.0 shall survive to the extent necessary to carry out their intent.

3.1 Termination for Breach: In the event of a breach of this Agreement, the non-breaching party may terminate upon 10 days' prior written notice. In the event of a cure by the breaching party during that time, the non-breaching party shall not be required to rescind the termination. Recision of a termination in any instance shall not constitute a waiver of the right to terminate for any future breach.

3.2 Return of Materials: Upon termination of this Agreement Contractor shall promptly deliver to LBG all Work Product of whatever nature or kind and all materials incorporating Work Product, Trade Secret, Proprietary or Privileged Information, and all work in progress.

RIGHTS IN DATA AND INFORMATION

4.0 Title: Contractor agrees that all Work Product shall remain the property of LBG and Client, and shall be kept separate and identifiable from other data, information, materials and Work Product.

4.1 Confidentiality: Contractor shall hold confidential all Work Product, Trade Secret, Proprietary and Privileged information. Contractor shall make sure its employees, agents and subcontractors at all times observe the terms of this Agreement relative to rights in data and information. The obligation of confidentiality shall survive termination of this Agreement.

4.2 Records: Contractor shall maintain records of the Services performed, including field logs, time sheets and payroll records, for one year after the Project is completed. Contractor shall make such records available for examination upon LBG's request.

INDEMNIFICATION

5.0 Contractor's Obligation: Contractor shall assume all risk of damage to property or of bodily injury, sickness, or disease of persons (including death resulting at any time therefrom) used or employed on or in connection with the work, and of all damage to property or of bodily injury, sickness, or disease of persons (including death resulting at any time therefrom) wherever located, resulting from or arising out of any

action, omission or operation under the contract or in connection with the Work. Contractor shall protect, defend, hold harmless, and indemnify DaimlerChrysler Corporation and LBG from and against any and all loss, cost, damage, expense, claims, or legal actions, whether groundless or not, arising out of the bodily injury, sickness, or disease (including death resulting at any time therefrom) which may be sustained or claimed by any person or persons, and the damage or destruction of any property, including the loss of use thereof, arising out of or related to the performance of any work in connection with this contract, including any extra work assigned to contractor in connection therewith, based upon any act or omission, negligent or otherwise, of (A) Contractor or any of its employees, agents, or servants, (B) any subcontractor of Contractor or any employees, agents, or servants of such a subcontractor, and/or (C) any other person or persons, including DaimlerChrysler, LBG, or any employees, agents, or servants of DaimlerChrysler and LBG. This indemnification shall include, but shall not be limited to, the obligation by contractor to protect, defend, hold harmless, and indemnify DaimlerChrysler and LBG from and against any and all claims for bodily injury, sickness, or disease (including death resulting at any time therefrom) and damage to property, based upon or alleged to have arisen out of (1) the sole active or passive negligence of DaimlerChrysler and/or LBG (except as prohibited by Michigan compiled laws annotated sec. 691.991); (2) the joint and/or concurrent active or passive negligence of DaimlerChrysler, LBG, and/or Contractor; (3) the joint and/or concurrent active or passive negligence of DaimlerChrysler, LBG, and/or any subcontractor of Contractor; (4) the joint and/or concurrent active or passive negligence of DaimlerChrysler, LBG and/or any other person or persons; (5) the joint and/or concurrent active or passive negligence of contractor and any other person or persons; (6) the joint and/or concurrent active or passive negligence of any subcontractor of Contractor and any other person or persons; (7) DaimlerChrysler or LBG's failure to provide a safe place to work; and/or (8) DaimlerChrysler or LBG's failure to take proper or reasonable safety precautions or exercise proper control with respect to the conduct of an inherently dangerous activity on or off its premises; and Contractor shall, at its own cost and expense, defend any such claims and any suit, action, or proceeding which may be commenced thereunder, and Contractor shall pay any and all judgements which may be recovered in any such suit, action, or proceeding, and any and all expense, including but not limited to, costs, attorneys' fees and settlement expenses which may be incurred therein. Contractor's obligation to defend, indemnify and hold harmless DaimlerChrysler and LBG shall survive termination of this Agreement.

INSURANCE

6.0 Requirement: Contractor will procure and maintain the Insurance as set forth in Exhibit "C". Contractor will not cancel any portion of such Insurance without 30 days prior written notice to LBG.

6.1 Proof: Before beginning any work under this Agreement, Contractor will deliver to LBG proof that Insurance is in force, and will ensure that current proof is on file with LBG until such work is completed. Such proof shall be in the form of a "Certificate of Insurance" providing the name and address of the insurance company, the name and address of the broker or agent, the expiration date, an acknowledgment of the required notice to LBG and Client in the event of cancellation, and **naming both Leggett, Brashears & Graham, Inc. and DaimlerChrysler Corporation as additional insureds.**

6.2 Subcontractors: Contractor shall require all subcontractors to procure and maintain at least the same Insurance as shown in Exhibit "C" and will provide current certificates that name Contractor, LBG, and Client as additional insureds for the Subcontractor's work.

MISCELLANEOUS

7.0 Project: Contractor represents that it has reviewed and is familiar with the Project and Services, and that Contractor accepts the work schedule and Scope of Services shown in Exhibit "B".

7.1 Assignment or Subcontract: Contractor shall not assign, transfer, or subcontract its obligations under this Agreement without the prior written consent of LBG, which shall not be unreasonably withheld.

7.2 Employee Compensation: Contractor is solely responsible for compensation of its personnel and subcontractors, maintaining required workers' compensation and employer's liability insurance, and payment of all federal and state income tax withholding, social security taxes, and unemployment insurance applicable to such personnel. Contractor shall bear sole responsibility for any health or disability insurance, retirement benefits, or other welfare or pension benefits (if any) to which such personnel may be entitled.

7.3 Governing Law: This Agreement shall be construed in accordance with the laws of the State of Ohio.

7.4 Notices: Unless otherwise provided herein, all notices shall be in writing addressed to the respective parties as shown above, unless another address shall have been previously designated, and shall be delivered to the other party by hand or by U.S. Mail, postage prepaid.

Date: _____, 1999

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7.5 Arbitration: All disputes regarding this agreement shall be submitted to binding arbitration pursuant to the rules of the American Arbitration Association, to be held in Minneapolis, Minnesota. Final judgment upon the award may be entered in any court of competent jurisdiction.

7.6 Partial Invalidity: If any provision of this agreement is determined to be unenforceable, the remaining provisions shall not be impaired.

7.7 Non Waiver: Failure to exercise any right hereunder shall not be deemed a waiver of such right. The recision of a notice of breach or a notice of termination shall not be deemed a waiver of any right accruing by reason of any future breach of performance.

7.8 Headings: The use of headings in the document is for convenience only. Headings shall not be considered as any term of the parties' agreement embodied by this document.

7.9 Merger: This Agreement, including the Exhibits, Schedules and Proposal annexed hereto, is the entire agreement of the parties and supersedes all prior representatives, proposals, discussions, and communications, whether oral or in writing. This Agreement may only be modified in writing and signed by all parties.

LEGGETTE, BRASHEARS & GRAHAM, INC.

By: _____

Its: _____

Date: _____, 1999

CONTRACTOR

By: _____

Its: _____

EXHIBIT "A"

EXHIBIT "A"

Project

LBG's Client is DaimlerChrysler Corporation, 800 Chrysler Drive, Auburn Hills, Michigan 48326. The work to be performed under this Agreement is detailed in Exhibit "B".

The site is located at 1600 Webster Street, Dayton, Montgomery County, Ohio.

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EXHIBIT "B"

EXHIBIT B

CONTRACTOR'S SCOPE OF SERVICES FOR SOIL SAMPLING OF STOCKPILED SOILS

PART 1 - GENERAL

Leggette, Brashears & Graham, Inc. (LBG) has been retained by DaimlerChrysler to collect soil samples from three separate soil piles (Soil Pile #1, #2, and #3) located at DaimlerChrysler's Dayton Thermal Products plant at 1600 Webster Street, Dayton, Ohio (figure 1). LBG is requesting that the contractor submit a cost estimate for a backhoe and trade-specific union operator to dig a series of test pits in the piles so that representative soils can be collected by LBG for laboratory analysis.

PART 2 - SCOPE OF WORK

Contractor shall furnish all labor, materials, and equipment required to complete the work. The work shall include, but not be limited to, all trade-specific union labor, mobilization, demobilization, traffic control, a backhoe to dig test pits from the tops and/or sides of each soil pile, replacing the unsampled excavated soils back into the test pits, tamping the test pit soils until level, site restorations, and all incidentals necessary to complete the work as described in these Specifications.

SOIL PILE #1

Soil Pile #1 is approximately 9 feet tall, has steep side slopes with a flat top, and contains approximately 8,500 cubic yards (yd³) of soil. The pile is covered with plastic sheeting that is held in place with a 4 to 8-inch thick layer of 1 to 3-inch diameter aggregate. The pile is composed mainly of fine-grained soils (silt and clay) mixed with lesser amounts of gravel. The pile also contains 4-inch diameter black perforated plastic piping which was used for bioremediating the soils. LBG does not know the quantity of piping within the pile.

LBG proposes to collect 5 (five) soil samples from 5 (five) test pits from this pile. Each test pit will be dug to near the maximum depth of the pile (9 feet) so that representative soil can be collected by the onsite LBG representative. At completion of sampling, the unsampled soils shall be replaced into the test pits and compacted. The pile shall be returned to its original condition. This includes the replacement of the aggregate over the disturbed materials. Access to this pile should not pose a problem.

SOIL PILE #2

Soil Pile #2 is approximately 8 feet tall, has steep side slopes with a flat top, and contains approximately 14,500 yd³ of soil. This pile is exposed to the atmosphere and is currently covered with near chest high heavy vegetation. This pile contains a mix of all soil types including cobbles, boulders, tree roots, concrete, and possibly some construction debris. The pile is underlain with plastic sheeting and a 1-foot high run-off control berm composed of soil surrounds the pile. It is unknown if bioremediation piping (plastic) is located within the pile.

LBG proposes to collect 5 (five) soil samples from 5 (five) test pits from this pile. Each test pit will be dug to near the maximum depth of the pile (8 feet) so that representative soil can be collected by the onsite LBG representative. At completion of sampling, the unsampled soils shall be replaced into the test pits and compacted. The side slope and top of the pile shall be returned to its original condition. Access to this pile should not pose a problem.

SOIL PILE #3

Soil Pile #3 is approximately 20 feet tall, has steep side slopes, and is somewhat conical in shape. This pile contains approximately 1,000 yd³ of sand, gravel, concrete, and other construction debris. In this case, we propose to use the backhoe to grab samples from two or three sides of the pile. Access restrictions to this pile include concrete block, construction debris, and old plant equipment that surrounds the pile. The total depth the backhoe would need to dig is contingent on access to the pile and pile contents. Restoration of this pile to its original conditions would not be required.

The undersigned has carefully examined the above request for services and other conditions relative to the work, and has made all evaluations and investigations necessary to gain a full understanding of pertinent site conditions and all regulatory, material, equipment, and labor requirements necessary to successfully and safely complete the work, as well as any reasonable difficulties which may be encountered in performing the work.

The undersigned hereby proposes and agrees to furnish all labor, materials, equipment, tools, taxes, services and all other items necessary or appropriate for the proper and complete execution of the work for the following estimated amount:

Base Bid Estimate

Backhoe/Union Operator, Cost/Hour: (\$ _____)

Total Estimated Cost: (\$ _____)

The undersigned agrees, if this proposal is accepted, to enter into an agreement LBG, per the Terms and Conditions of LBG's Standard Form Contract, for the above estimated Contract Sum.

PROJECT INITIATION

If awarded this contract, the undersigned proposes and agrees to start work as early as July 1999.

BID ACCEPTANCE

In submitting this proposal, it is understood that Leggette, Brashears & Graham, Inc. and DaimlerChrysler Corporation reserve the right to reject any or all bids, waive any formalities or technicalities in any bid and to make an award in the best interest of Leggette, Brashears & Graham, Inc. and DaimlerChrysler Corporation. It is further understood and agreed that this

proposal may not be withdrawn for a period of sixty (60) calendar days after the date set for bid receipt.

Respectfully Submitted:

Contractor

Date

Signature

() _____
Telephone Number

Name and Title

() _____
Fax Number

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EXHIBIT "C"

EXHIBIT "C"

EXHIBIT "C"

Insurance Requirements

Contractor and all subcontractors shall, during the continuance of the work thereunder, including extra work in connection therewith, maintain the following insurance coverages with carrier's rated A- or better by Best's Insurance Rating Services:

A. **Statutory Worker's Compensation** coverage and a minimum limit of \$500,000.00 Employer's Liability coverage for all states identified in the Project, including Long Shoreman's and Harbor Workers Act coverage, if applicable, and any insurance required by NY Employee Benefit Acts or other statutes applicable where the work is to be performed. All such insurance shall be in amounts sufficient, in the opinion of LBG and Client, to protect Contractor and subcontractors from any liability for bodily injury, sickness, or disease (including death resulting at any time therefrom) or any of their employees, including any liability or damage which may arise by virtue of any statute or law in force or which may hereafter be enacted.

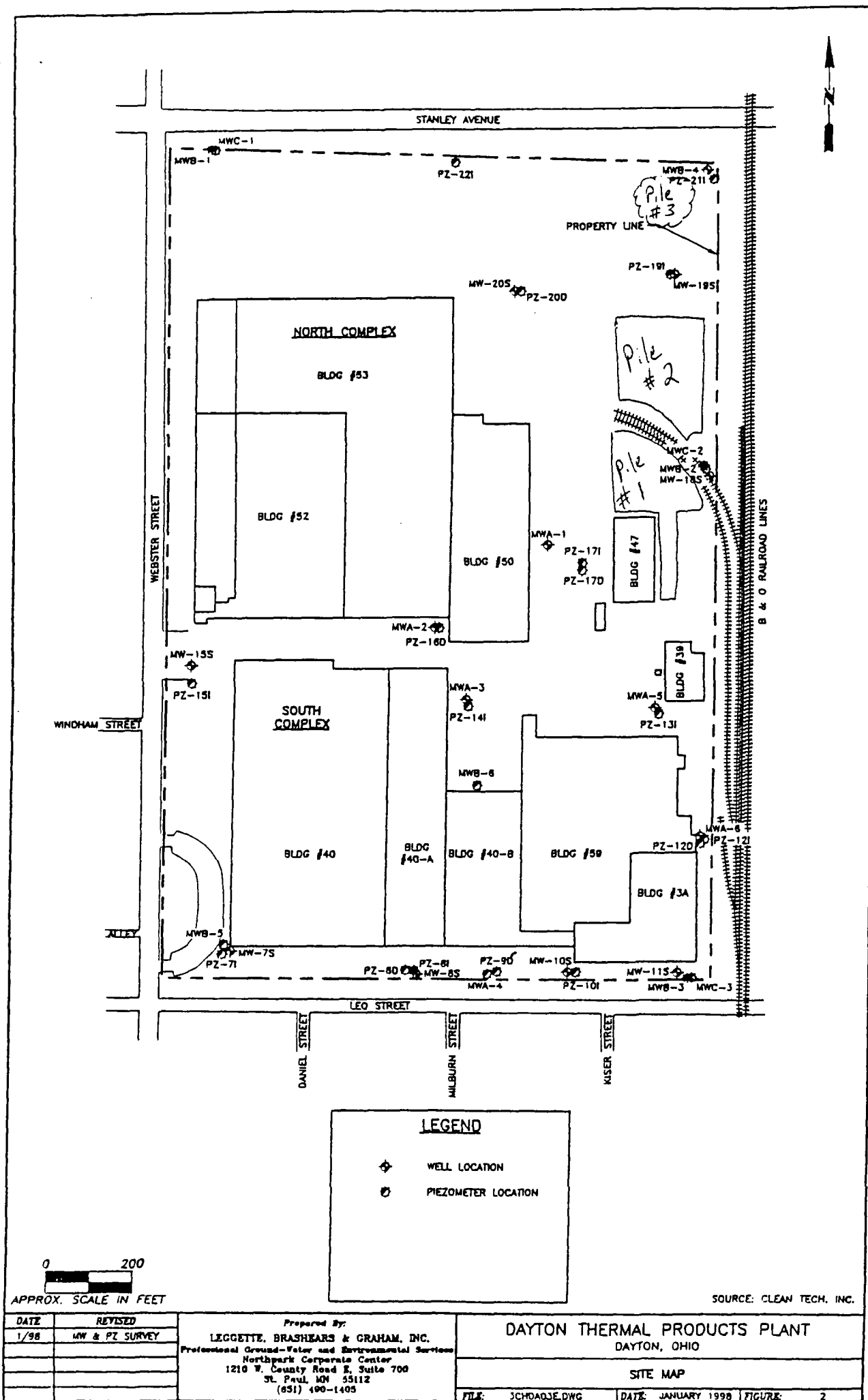
B. **Comprehensive General Liability** and property damage insurance of at least \$5,000,000.00 combined single limit, bodily injury, and property damage as protection against all risks of damage to or destruction of property or bodily injury, sickness or disease (including death resulting at any time therefrom) of persons, wherever located, resulting from any action, omission, or operation under the contract or in connection with the work; endorsed to show LBG and Client as additional insureds, and including broad form contractual liability coverage, completed operations liability coverage, products liability coverage, coverage for explosion or blasting hazard, coverage for collapse hazard or structural injury, and coverage for underground hazard (deletion of the "X", "C" and "U" exclusions). The policy shall provide for a minimum 30 days notice of cancellation (10 days for non-payment, termination or non-renewal to LBG and Client).

C. **Comprehensive Automotive Liability** insurance, including property damage, covering all owned, non-owned or rented equipment used in connection with the work, in the minimum amounts of \$1,000,000 per person, \$1,000,000 per occurrence for bodily injury (including death resulting at any time therefrom), including no-fault (PIP, BRB) and uninsured motorists coverage and \$1,000,000 per occurrence for property damage.

D. **Contractor's Pollution Liability** coverage of at least \$2,000,000.00 per occurrence and \$5,000,000.00 aggregate.

All insurance policies required hereunder shall be issued by companies authorized to do business under the laws of the state or province in which the work will be performed, such policies (excluding Workers' Compensation) shall name LBG and Client as additional insureds thereunder and shall contain endorsements stating they are primary and not excess over or contributory with any other valid, applicable, and collectible insurance in force for LBG and Client. Such policies shall further contain appropriate endorsements extending the coverage thereunder to include the liability assumed by Contractor under this contract. LBG and Client may require Contractor to furnish evidence of the foregoing insurance at LBG's and Client's option, but Contractor's failure to comply with said insurance requirements shall not relieve Contractor of its liabilities and obligations under this clause and LBG and Client action or inaction shall not act as a waiver of any of LBG and Client's rights as described in this clause.

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LEGEND

- ◆ WELL LOCATION
- PIEZOMETER LOCATION

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APPROX. SCALE IN FEET

SOURCE: CLEAN TECH, INC.

DATE	REVISED	Prepared By:	DAYTON THERMAL PRODUCTS PLANT DAYTON, OHIO	
1/98	MW & PZ SURVEY	LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services Northpark Corporate Center 1210 W. County Road E, Suite 700 St. Paul, MN 55112 (651) 490-1405		
			SITE MAP	
			FILE: JCHD03E.DWG	DATE: JANUARY 1998 FIGURE: 2